AUGUST 1951

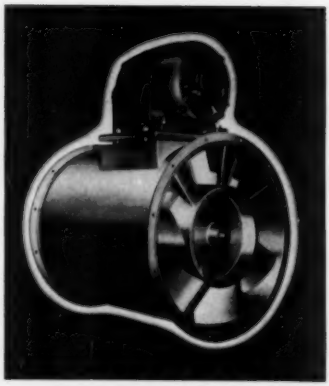
INDUSTRY AND POWER

For Executives and Engineers Responsible For Engineered Plant Services

Featuring:

Burning Spent Sulphite Liquor to Generate Steam ..... Page 61
L-P Gas in the Heat Treatment Field ..... Page 65
Cover Illustration — Union Carbon and Carbide Co. ..... Page 84

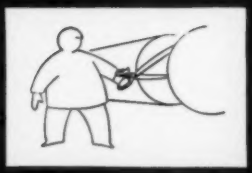
the HARTZELL vaneaxial blower is *EASY* to install

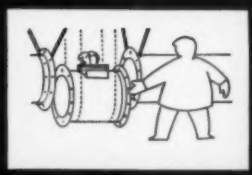


A POWERFUL BLOWER

efficient against very heavy pressures

Maybe you didn't realize this: A single Hartzell 48" Vaneaxial Blower can move 71,100 CFM against a half-inch static pressure, consuming just 50 HP, or 41,100 CFM against *seven-and-a-half* inches, with 65.3 HP. That's air-moving power against pressure! So, you see, there's no need to put up with clumsy, power-wasting air-moving devices which require an engineering crew for installation and clutter up valuable floor space. Get the *complete* economy of Hartzell Vaneaxial Blower design and construction . . . economy which begins with purchase price and installation and saves your money year after year after year.





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For every V-drive, there's *one* belt construction that's right—combining materials and design to handle drive requirements longest, and at the lowest cost in the long run. That's why the G.T.M. —Goodyear Technical Man—has developed the most complete line of V-belt constructions in the industry.

Ask your nearest Goodyear distributor—or the G.T.M.—about

E-C CORD V-BELTS for high-speed drives with small pulleys, short centers.

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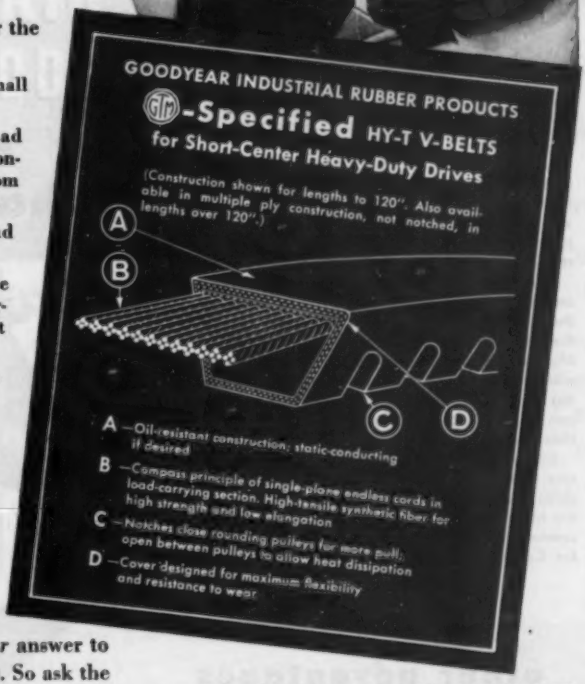
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GTM-Specified HY-T V-BELTS
for Short-Center Heavy-Duty Drives
(Construction shown for lengths to 120". Also available in multiple ply construction, not notched, in lengths over 120".)
A
B
C
D
A —Oil-resistant construction; static-conducting if desired
B —Compass principle of single-plane endless cords in load-carrying section. High-tensile synthetic fiber for high strength and low elongation
C —Notches close rounding pulleys for more pull; open between pulleys to allow heat dissipation
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FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS *built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.*

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THE GREATEST NAME IN RUBBER

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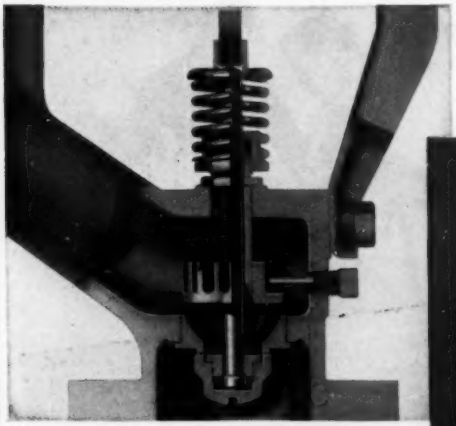
Adjustable Pressure Control



one reason

why more

DIAMOND G9B SOOT BLOWERS

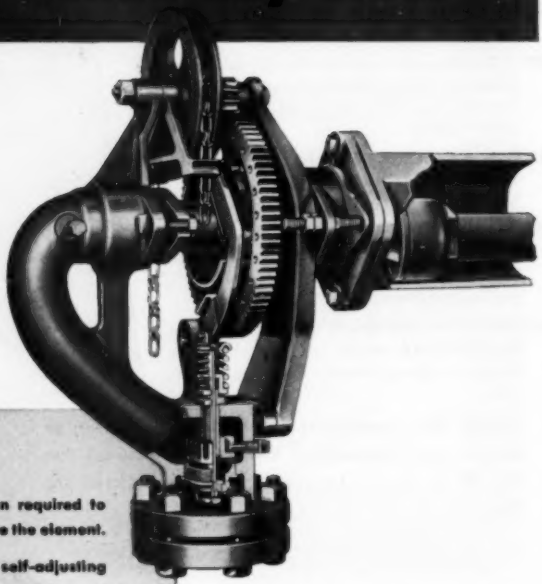
are in use than any other

Diamond Integral Adjustable Pressure Control is a simple, effective device used where the steam pressure is higher than needed for good soot blowing but not so extreme as to require a reducing valve.

It consists of a pressure control disc carried on the threaded valve stem guide. By removing the plug shown, the ribs on the upper part of the disc can be engaged by a screw driver. Moving the ribs screws the disc up or down, widening or narrowing the opening and increasing or decreasing the effective pressure. A gauge can be installed at the top of the gooseneck to check pressure setting.

Individual G9B units can be made automatic any time after installation by simply adding a drive to existing equipment. Then, all blowers on the boiler can be made automatic sequential in operation by addition of a control panel. Write for Catalog No. 1014 for further information.

3704



other advantages

Automatic Valved Head . . . only one operation required to open and close the valve and simultaneously rotate the element.

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Poppet Type Valve . . . experience proves it to be the best type of unlubricated valve for rugged work.

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Lancaster, Ohio

DIAMOND SPECIALTY LIMITED
WINDSOR, ONTARIO

Edited specifically for executives and engineers responsible for the selection, installation, operation & maintenance of equipment required for Engineered Plant Services*

INDUSTRY AND POWER

The Magazine for Engineered Plant Services

INDUSTRY AND POWER

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***Engineered Plant Services**

By ***Engineered Plant Services*** we mean the ***providing*** or ***generating, transmitting, controlling, applying,*** and ***maintaining*** of POWER, STEAM, MECHANICAL DRIVES, HEAT, ELECTRICITY, AIR, WATER, and other engineered services in and for all areas of the industrial establishment as required for production and operation. This includes Lubrication, Piping Systems, Industrial Waste Disposal, Corrosion Control, Electrical Systems, Industrial Heat, Coal and Bulk Handling, Dust and Fume Control, and other related services of an engineering nature.

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TO A MINIMUM

CHECK BOILER WATER
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BOILER WATER
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Model P contains either High or Low Phosphate Comparator. Model W (shown above) contains same, plus 3 pH slides (pH 7.2 to 8.8); (pH 8.6 to 10.2); (pH 10 to 11.6) plus accessories and instructions for use.

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Acorns of Science

Developments not yet available, but of interest to those who are responsible for Engineered Plant Services

Fast Silica Determination

● Dispersion staining, a technique which involves putting a dust sample on a glass slide and adding a liquid with the same refractive index as free silica, is used in a faster and more accurate method for detecting size and quantity of silica particles included. The method, reported by Bausch and Lomb Optical Co., apparently allows determination of the amount of silica by causing it to disappear when viewed under a microscope after being stained with the liquid that prevents further dispersion of light hitting the silica.

Lubricants and Heat

● A torture chamber for lubricants under high-temperature, high-speed operating conditions is in operation at the Naval Engineering Experiment Station. Greases under test are applied to ball bearings, run at speeds and loads simulating actual operations in ovens where temperatures can be maintained as high as 500 F. Apparatus permits control of thrust and radial loads. Tests indicate temperature rise from 250 to 300 F cuts effective life of standard petroleum grease by 90 per cent. Silicone grease is better, withstood 400 F for 400 hr.

Flame Tests Water

● Quick new method for determining water treatment needed for makeup in boilers is reported by Hall Laboratories, Inc. Sample is atomized in flame and a spectrophotometer breaks the light into separate wave lengths, measuring their intensity. This determines elements dissolved and their concentration in a matter of minutes, rather than the hours previously required. Results are rapid, sufficiently accurate for all control applications.

Determination of alkali metals is important in accuracy of analyses. By finding cation concentrations, accuracy is checked by balance of cation and anion equivalents. Deposits are analyzed by dissolving in water and testing the same as water samples.

Fuel Cyclone

● Using a type of furnace which is already installed in several locations in the country, Babcock & Wilcox Co. is making tests which should lead to better efficiencies from low grade furnace fuel suitable for industry.

The cyclone furnace, a new type in which fuel and preheated air are introduced with a swirl at one end of the unit, is being used for the tests. Whirling action coats walls of furnace with a molten layer of ash into which fuel is thrown by centrifugal force. Combustibles burn, residue melts and drops into pit as slag, reducing ash discharge from stack. Present tests should increase supplies of fuel practical for industrial use.

Scrap Pile Technicians

● From maintenance areas of the Korean war comes a gadget which someday may be adapted to give better performance on industrial engines. Simple fuel injection nozzle tester devised by Air Force mechanics at Okinawa saves B-29 maintenance crews hours of time formerly spent in locating malfunctioning nozzles, insures against dangerous and costly engine failures. Built by mechanics using "on the spot" materials, the device features a gas-tight plastic box in which suspected nozzles are tested under pressure. Visual check of gasoline spray angle quickly indicates if nozzle operates properly.

Proxy Circuits

● The small analog computor reported by the Philadelphia Electric Co. at the AIEE summer general meeting can solve transient heating problems in cable systems under any load variations. An electric current is fed into an equivalent network. Voltage developed is measured as a function of time. Current may be constant or may be varied according to any loss cycle. Voltage change can be checked at any point of the electrical cable network.

COOL HEADS IN "HOT SPOTS" WON'T LET YOU DOWN

On jobs where the air is foul or hot, men can't be blamed too much for letting up now and then. If you want to keep their efficiency and morale high, feed them better air.

Employers have learned the value of putting Coppus Blowers and Ventilators on the job . . . in confined areas and near furnaces or hot processes. The men work faster, do better work, work longer without fatigue — and appreciate the more comfortable working conditions.

Give some thought now to the "hot spots" in your plant. There is a Coppus Blower for practically any requirement — Cable Manhole and Tank Ventilators, Boiler Manhole Blowers and Exhausters, Heat Killers, Shiphold Ventilators, etc. The Coppus "Blue Ribbon" is your assurance of design and construction planned for plenty of severe service. Check and mail the coupon for specific information. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP., 188 PARK AVENUE, WORCESTER 2, MASS.
Please send me information on the Blowers that clear the air for action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ galvanic ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausters, welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

(Write here any special ventilating problem you may have)

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

new equipment and developments

You can easily get more data on these new equipment and development items. Use the handy, postage-free order cards between Pages 92 & 93. List key numbers of the descriptive paragraphs in the space provided on the card and mail

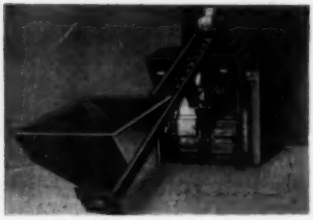
1—LIGHT CONTROL IS PLUG-IN TYPE

A weatherproof illumination control of the plug-in type is announced by the Weston Electrical Instrument Corp. It is mounted in a standard weatherproof watt-hour meter glass case, consists of a stable dry-disc type

photocell, a sensitive relay which is operated directly by the photocell, a clock motor, mercury switch and limit switch. Installation requires only plugging into a standard watt-hour meter receptacle.

2—STOKER CONVEYER HANDLES WOOD COAL

Stoker feeder screw conveyer manufactured by American Coal Burner Co., Inc., will deliver up to 500 bhp of wood chips, hogged wood, sawdust or coal. It is easily



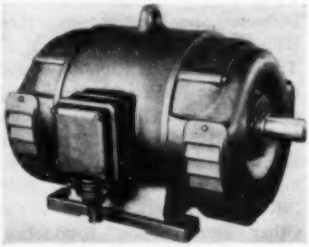
adaptable to most boiler rooms and can be used in connection with present stokers. A variable speed drive can be furnished as extra equipment. Designed to increase boiler room efficiency, it feeds fuel automatically and frees the attendant for other duties.

3—PAINT SEALS AND PREVENTS RUST

A penetrating and sealing anti-rust paint, PCA-100, which can be applied over rusted surfaces, is announced by the Paint Corp. of America. Suitable for both interior and exterior use, the new paint is equally effective in preventing rust on new metal or stopping rust action without extensive surface preparation such as wire brushing, scraping or sand blasting. Upon application, it penetrates through the rust layer into the base metal and seals the surface against further rusting. The paint, suitable for either brush or spray application, is furnished in black only and, due to its penetrating characteristics, should be used solely as a "finish" coat. A companion product, PCA-101 is a clear paint, equally effective for rust prevention, and can be painted over with any standard paint of any color.

4—MOTOR AND BRAKE ARE COMBINED

A motor that is a combination brake-and-drive in one unit announced by Brown Boveri Corp. is specially designed for use as initial equipment or for replacement where frequent starts and stops are required. No outside power source or special controls are needed for applying or releasing the brake. When power is cut, it brakes and stops with 150 per cent of normal



torque. There is no creep and no backlash. Mounting may be horizontal or vertical and for forward or reversing operations. The motors are available from .3 to 8 hp in drip-proof and .2 to 4 hp totally enclosed designs.

5—OIL ADDITIVE REDUCES FRICTION

Announced by the Friction-Proof Oil Corp., this low friction lubricant will, by itself, flow and protect bearing surfaces between —60 and 660F. It may be added to other lubricating oils and greases, from which it will not separate, assuring a perfect oil wedge. One of the best corrosion inhibitors, it leaves no deposit which might destroy bearing surfaces. When used as an additive, lubrication qualities are retained between 20 and 550F, allowing higher speeds than could be obtained with standard petroleum lubricants.

This lubricant, Addit, is recommended for high pressure usage, especially in heavy duty gears, bearings, journals and shafts. It is also particularly recommended for all year protection of diesel and gasoline engines, in which it can prevent corrosion, eliminate gum, sludge and carbon formations and improve cleanliness of carburetors, injectors and pumps.

6—SEAL WATERPROOFS CABLE TERMINALS

An inexpensive moisture seal for terminating multi-conductor sheathed cables is now offered by The Okonite Co. Cone-shaped to receive filling compound, this device is easily and quickly slipped over the cable and eliminates the friction tape or makeshift windings.

Applicable to cable diameters of from 3/4 to 2 in., it fits snugly over the cable

sheath, preventing compound leakage. The compound hardens to form a neat, permanent, moisture-proof seal and keeps the conductors properly spaced.

7—RUBBER OVERLAY FOR ALL FLOORS

Recently marketed by Flash-Stone Co., advantages claimed for a synthetic rubber flooring material are strength and long life, resistance to acids, alkalis, water and other

destructive agents, low cost and ease of application. Vulcrete will dry to a pleasing light concrete color, bond inseparably without need for preliminary bonding with wood, metal, concrete, brick, slate, stone, asphalt mastic, composition or similar bases

(Continued on page 10)

SILENTLY, but ruthlessly *(even as you are reading this)* rust is gnawing away at machines, tanks, fences, pipes, fire escapes, metal sash, stacks —every rustable metal—inside and outdoors!

To protect your investment—to keep every possible pound of new steel for the defense program—to make all rustable metal surfaces last longer—*adopt rust control with RUST-OLEUM as an important part of your maintenance program.*

RUST-OLEUM stops rust! Its tough, pliable, rust-resisting film gives excellent protection that prevents rust losses under many difficult rust-producing conditions.

RUST-OLEUM can be applied even over rusted sufaces. It is not necessary to remove all the rust. Just use wire brush and sharp scraper to remove rust scale and loose rust. Economical and easy to use because no sand blasting or chemical pre-cleaning is required.

RUST-OLEUM can be obtained promptly from Industrial Distributors' stocks in principal cities of the United States and Canada. Anticipate your needs and order now! For complete catalog see *Sweet's*, which also lists your nearest source of supply, or write on your company's letterhead for full information.

RUST-OLEUM CORPORATION
2472 Oakton Street, Evanston, Illinois

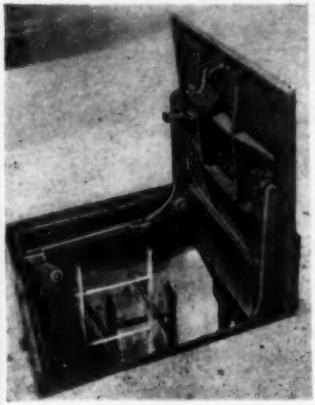
(Continued from page 8)

and have very high resistance to point loads of considerable weight.

It is recommended for leveling and resurfacing all worn or splintered floors, and is a pronounced sound dampener, as when used over steel plates.

8—VAULT COVER FEATURES SAFETY

Counterbalanced vault or manhole cover, made by E. H. Wachs Co., is designed for safe and easy operation. Opening is accomplished by inserting a combination key-



handle and giving it a half turn. Lifting the cover to its vertical open position is a one handed job because of counterweights, which also hold the cover in a protective upright position. Cover can be opened from inside of the vault by one man, positive tamper proof lock can not be opened without key-handle. Counterbalance structure protrudes less than 6 in. from wall. 30 in. square opening has heavy duty cast iron frame and ribbed steel cover machined for accurate rattle proof fit.

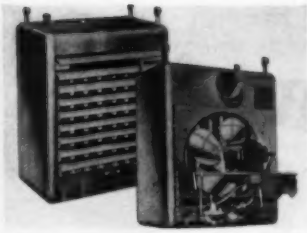
9—CASE HARDENS CONCRETE

A liquid produced by Flexrock Co. transforms "bare" concrete surfaces, which ordinarily absorb oil, grease, and other disintegrating liquids, into case hardened surfaces impervious to destructive chemicals. Flintcrust Liquid counteracts and prevents "sanding" and eventual surface breakdown; prevents "drag" of material handling equipment, thereby facilitating mobility of vehicles. It is easily applied by flushing, without interrupting normal plant operation. Approximate coverage is 7/8 gal per 100 sq ft and it is available in 6, 12, 18, 30 and 55 gal containers.

10—UNIT HEATER LINE ANNOUNCED

Gas-fired unit heaters, including fan, blower and duct-type models, with sheet steel and cast iron heat exchangers are announced by the United States Air Conditioning Corp.

Designed for use with natural, manufactured, mixed or propane gas, the heaters are housed in heavy gauge steel cabinets. Four point suspension permits rigid mounting without strain on gas lines or



piping. Adaptor kits are available when two point suspension is specified. The units can be mounted within 6 in. of the ceiling. A hinged lower panel gives easy access to internal parts.

All the heat generated by the burning gas is delivered directly to the heat exchangers and then to the circulating air.

Series 23 unit heaters, with sheet steel heat exchangers, are available in the fan type in sizes ranging in capacity from 55,000 to 200,000 Btu per hr and are also offered in blower-type models, with adjustable motor pulleys to permit changing the blower speed.

Series 20 heaters, equipped with cast iron heat exchangers, in capacities of 100,000 and 135,000 Btu per hr, are available in standard propeller fan, blower and duct types.

Heaters are completely equipped with all standard safety controls. All units listed are AGA tested and approved.

11—DRY CHEMICAL FIRE EXTINGUISHER

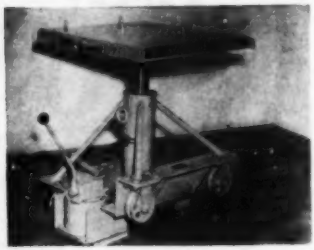
A 4-lb capacity dry chemical fire extinguisher with a rubber hose is introduced by Ansul Chemical Co., and offers the advantages of ease of operation, flexibility in fighting overhead and ground-

level fires, and maximum extinguishing effectiveness for inexperienced operators.

Discharge time has been increased for more time to extinguish the fire, operating range is 12 to 15 ft. It has received a B2, C2 rating from Underwriter's Laboratories. The extinguisher is pressurized by a 1½ oz carbon dioxide cylinder in the dry chemical chamber. Addition of the self-closing nozzle makes the new unit weather-tight for maximum protection.

12—ELEVATING TABLE HANDLES HOT MOLDS

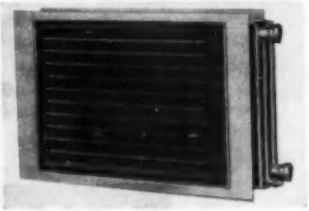
Hot, heavy curing molds in a rubber processing plant are positioned and carried on special hydraulic elevating tables manufactured by Lyon-Raymond Corp. Serving a battery of presses, each table has two offset grooved wheels which run on angle



iron tracks. The top lowers to 28 in. and raises to 44 in. Table capacity is 2000 lb and the heavy molds roll onto the top, over a single roller mounted on the front edge, to two stops at the back. The top will turn 360 deg or can be locked in one fixed position. Elevation is by 2-speed hand pump.

13—HEATING COILS FOR PRESSURES TO 125 PSI

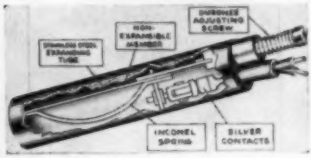
A line of steam heating coils for use in combination with air conditioning coils or as tempering and booster units in long heating ducts is announced by Rempe Co. They are available in both single and double row design. The single row are



ideal for booster and tempering service and the double row for heavy duty or mixed air heating service. Capacities range from 60,000 or 775,000 Btu per hr.

14—THERMOSTATS FEATURE LOW MAINTENANCE

Originated by the Smith Control & Instrument Corp., these expanding tube thermostats utilize a stainless steel tube as the expanding member and an invar strip as

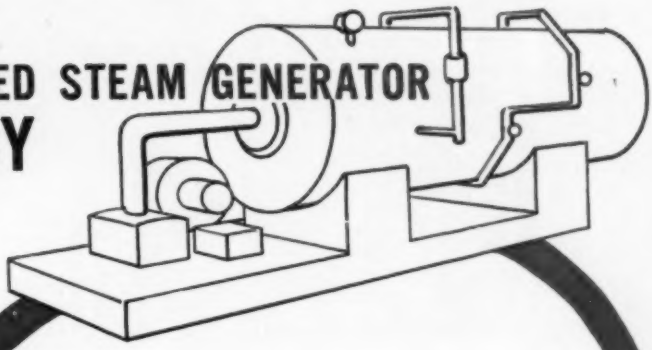


the non-expanding member. An inconel spring gives fast make and break action. An alloy adjusting screw permits quick and easy setting of the control point at

(Continued on page 14)

Ideal Combination

FOR TOP SELF-CONTAINED STEAM GENERATOR EFFICIENCY



1

Nalco WATER TREATMENT
SCALE AND CORROSION PREVENTION

With a Nalco Service Policy and Nalco Chemicals to fit your water treatment requirements, you can keep your self-contained boilers operating indefinitely at top efficiency — without any of the costly difficulties caused by scale and corrosion. This part of the Nalco System was designed expressly to provide small boiler users with the same complete water treatment services enjoyed by thousands of the country's largest power plants. A new 4-page bulletin gives complete details on The Nalco System as applied to the modern self-contained boiler. Your copy will be sent promptly, without obligation.

Write for Bulletin 49

2

Nalco SR-155 FUEL OIL ADDITIVE
FUEL SAVING . . . CLEAN BURNERS

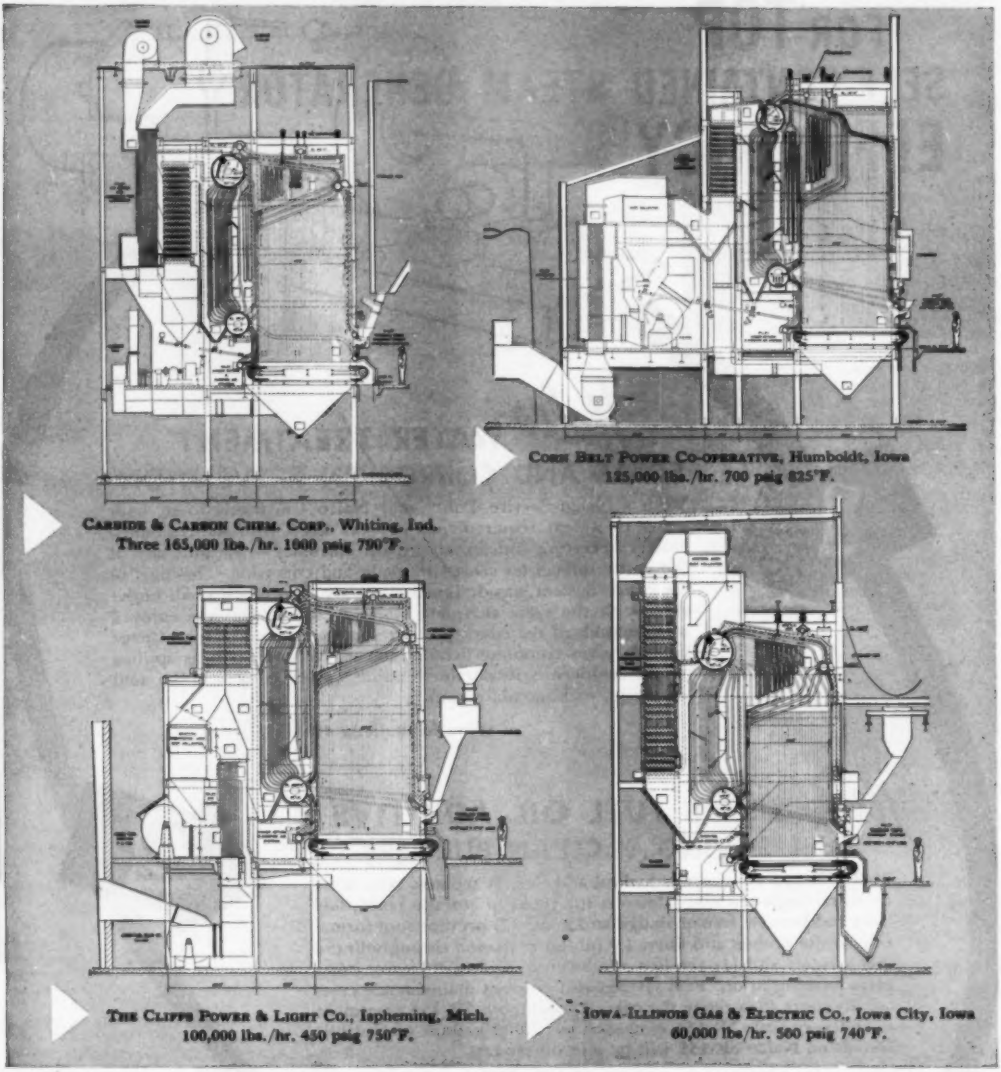
Nalco SR-155 is a *complete* fuel oil additive. It replaces two, three or more single-purpose additives to: (1) keep storage tanks, fuel lines and burners free of sludge and gum; (2) prevent soot formation in the firebox and flues; (3) inhibit corrosion throughout the fuel system; and (4) act as a combustion catalyst to assure complete burning of oil. Fuel savings and reduced maintenance costs usually more than repay the cost of continuous SR-155 treatment — and very little SR-155 is needed per 1,000 gallons of fuel oil! Details on Nalco SR-155 will be sent on request.

Write for Bulletin 46

NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE Nalco SYSTEM • Serving Industry through Practical Applied Science

A few outstanding Spreader-Stoker



Carbide & Carbon Chem. Corp., Whiting, Ind.
Three 165,000 lbs./hr. 1000 psig 790°F.

Corn Belt Power Co-operative, Humboldt, Iowa
125,000 lbs./hr. 700 psig 825°F.

The Cliffs Power & Light Co., Ispheming, Mich.
100,000 lbs./hr. 450 psig 750°F.

Iowa-Illinois Gas & Electric Co., Iowa City, Iowa
60,000 lbs/hr. 500 psig 740°F.

TRADE MARK Rx REGISTERED

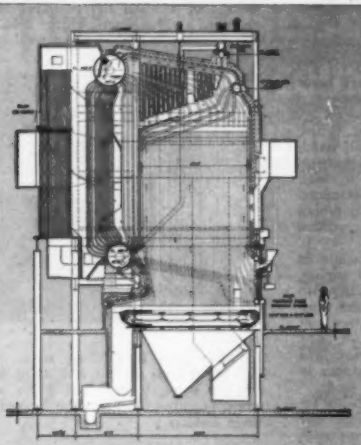
RILEY

STOKER CORPORATION, WORCESTER, MASS.

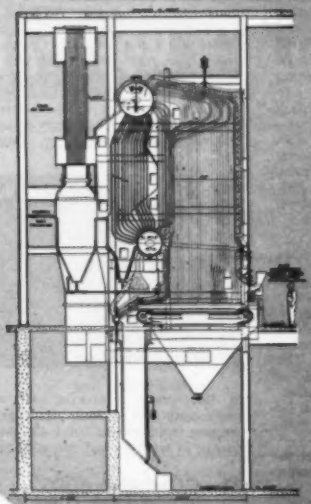
Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston Denver
Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

fired RILEY Steam Generating Units



Eugene Water & Electric Board, Eugene, Ore.
175,000 lbs./hr. 700 psig 835°F.
Waste wood is also burned.



Ohio Edison Co., Akron, Ohio
90,000 lbs./hr. 250 psig

Compare the Construction of these Important Parts . . .

Grate Drive

Riley uses a hydraulically driven ratchet drive, completely enclosed and automatically lubricated. This simple rugged drive operates with practically no maintenance and is not susceptible to damage in case of grate obstruction. No sprockets, chains or speed reducers are required.

Feeder Distributor

The use of an adaptation of the Stephenson link mechanism provides complete speed control. The entire mechanism is enclosed and splash lubricated. The overthrowing distributor gives uniform longitudinal and lateral distribution and prevents damage and outage caused by wedging of foreign materials between distributor and housing.

Grate Surface

The grate surface is made up of small grates, only 2 inches wide by 6-inch pitch, mounted on carrier bars. The use of small grates assures low maintenance and long life by providing adequate cooling and the elimination of warping and cracking. Uniform air distribution is obtained.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

(Continued from page 10)

any temperature up to 600 F, and no elaborate heating or cooling procedure is required to stabilize it. Massive silver contacts provide two breaks in series for 600 w loads at 110 or 230 v, a-c or d-c.

15—GAGE MEASURES TEN PER CENT STRAINS

Strains up to 10 per cent in materials or parts can be measured accurately by means of the SR-4 "Post-Yield" strain gage, Type PA-3, announced by Baldwin-

Lima-Hamilton Corp. It enables measurement of strains far beyond the range of other SR-4 bonded resistance wire strain gages.

The gage has a flat-grid paper-base construction and requires a special air-drying cement which is supplied with it. It has a resistance of 120 ohms, gage factor of 2.0, gage length of 13/16 in., and minimum trim width of 15/32 in.

16—INSTRUMENT CHARTS SPEED VALUES

Speed indicating and recording instruments are announced by O. Zernickow Co. The O-Z improved hand tachometer, 3 in. dial, single spindle, quintuple selective range, with rotating gear shift is made in three different range combinations for speeds 30-48,000 rpm, 15-24,000 fpm. Accuracy is 0.5 per cent at any point of scales.

By combining a special adaptation of the tachometer mentioned above with a precision recording mechanism, a portable tach-

ograph which will often take the place of expensive stationary equipment is produced in the same ratings. Everything the tachometer indicates is recorded for reference. The time is marked horizontally and the speed vertically. Speed fluctuations, accelerations, decelerations, belt slippage may be recorded with the instrument.

17—WELDED FITTINGS ARE CORROSION-RESISTANT

Formerly thought impossible, welding fittings and joints for corrosion resistant coated piping are announced by Welstrom. At present, only mechanical type joints are available for use with internally coated

For more information use one of the handy reply cards between pages 92-93. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

piping systems. Therefore, failures occur at the joints due to vibration, expansion and contraction. The new Welstrom fittings and joint eliminate such failures. These fittings and joints are available in all standard sizes and types from one half inch up to thirty inches in diameter. With them, the lower cost and construction advantages of welded piping can be enjoyed in piping systems handling many types of corrosive solutions.

Turbulence, a prime cause of failure in many types of corrosion resistant piping, is eliminated because the fittings have an internal diameter identical with the pipe. They are treated with corrosion resistant coatings in the manufacturer's plant. Any alterations, which are necessary for field assembly, resulting from slight changes in design layouts, can be made in the field.

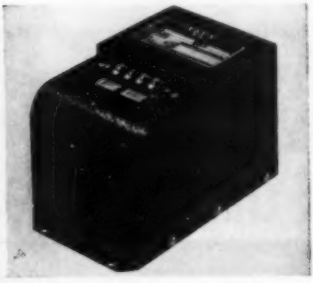
A typical fitting has three parts, an internal sleeve and two external fittings. The joint fittings are welded to the pipe ends and both are then coated with a corrosion resistant material. The sleeve is then inserted into the fittings, which are then butted together and field welded. This welding, of course, destroys the coating both inside and outside the fitting for one half inch on each side of the weld. On the outside cold setting coating can easily be applied. Then through a threaded opening a cold setting compound is introduced into the interior of the fitting and the opening is sealed with a pipe plug.

Standard fittings in the various sizes include: concentric and eccentric reducers, 90 deg reducing elows, lap joint stub ends, 45 deg elbows, straight tees, reducing outlet tees, 180 deg return bends and crosses.

18—ELECTRICAL CONTROL IS SENSITIVE

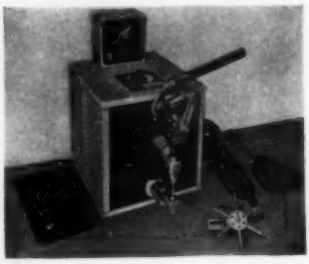
An electrical device developed by the Sola Electric Co. controls electrical machinery by reacting to very slight changes in the voltage of alternating current. Using inductive-capacitance resonance, it responds to changes as small as one-half volt. The Sensivolt can be employed to react automatically to whatever unpredictable fluctuations occur in line voltage; or it can be stimulated deliberately by modulating voltage at the power source.

Among initial uses are remote operation of auxiliary power equipment; protection of electrical equipment against high or low voltage; step by step voltage regulation; and control of several selective voltage circuits from a single variable voltage source.



19—SPOT WELDER ALSO SOLDERS, BRAZES

Joyal Products, Inc. announces a resistance spot welding and soldering machine equipped with timer which also silver solders and soft solders. Spot weld capacity



for steel parts is 3/32 of an in. and it will solder brass up to 1/8 of an in. Ratings are 110 v a-c, 9 amps and 220 v a-c, 10 amps (equipped with water cooled electrode holders.)

20—GENERATOR PROVIDES 400 CYCLE CURRENT

A high-frequency alternating current generator manufactured by the Kato Engineering Co. has a capacity of 75 kva and generates 400 c at 1714 rpm. Of the revolving field type, the field coils are energized from a 125 v d-c exciter on an extension of the alternator shaft.

These generators are available in both single-phase and three-phase designs, most common being 110/220 v, single phase,

or three-phase, four-wire, 120 v, single phase with 208 v, three phase. Frequencies ranging from 300 to 500 c are available by change in winding and operating speed.

21—COMPANY ADDS PYROMETER SUPPLIES

A series of pyrometer supplies have been developed by Minneapolis-Honeywell Regulator Co., and five supply items have been announced by the company's Brown Instruments Div. A cast iron, closed-end protecting tube for molten aluminum applications features a service life several times that of former models. The tube is described as being of dense cast iron having a smooth outer skin. The tube has a 1-15/16 in. OD by 13/16 ID. It comes in lengths of 12, 18, 24, 30 and 36 in.

A two-conductor, 24-gage copper constantan thermocouple wire has been developed for refrigeration applications. The model has a moisture-proof polyvinyl-chloride insulation. Over-all dimensions are approximately 3/64 by 3/32 in. Field tests show the thermocouple has a temper-

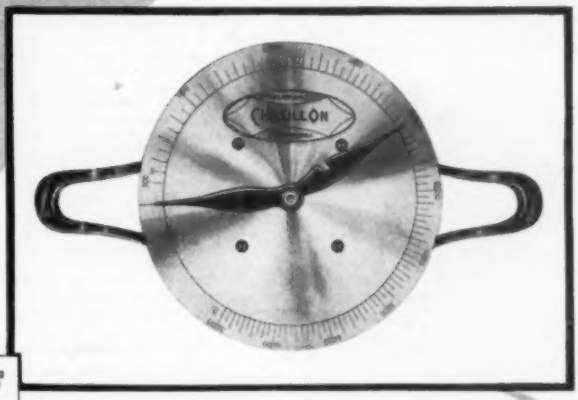
(Continued on page 16)

WHEN THE PRESSURE OF INDUSTRY IS GREAT...COUNT ON CHATILLON FOR UNFAILING AID!

Since 1835, John Chatillon & Sons have been world famous for the precision manufacture of force measuring devices which meet the most specific requirements of industry.

CHATILLON TRACTION DYNAMOMETERS

- For determining sag in stringing transmission lines.
- To ascertain force required to pull underground cables and wires through conduits.
- For guy wire tensions, pole, insulator and anchor strength.
- For use in conjunction with apparatus that apply force to test strength of materials and structures.
- Gear Mechanism is Enclosed in Dustproof housing.
- Accuracy is Guaranteed to within 2% plus or minus of dial reading.



Traction Dynamometers are made in Capacities shown below:

Capacity & Graduations in lbs.	First Dial Reading lbs.	Dial Dia. Inches	Shipping Weight lbs.
1000 x 10	100	7	8
2000 x 25	150	7	9
5000 x 50	250	8	9
10000 x 100	500	10	15
25000 x 200	600	14	45
50000 x 250	1000	16	56
100000 x 500	1000	18	95

Larger Capacities to Order

FILL IN AND MAIL COUPON TODAY

John Chatillon & Sons, 87 Cliff Street, New York 7, N. Y.

Gentlemen: Please send me complete brochures on

☐ Traction Dynamometers ☐ Push Pull Gauges
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Name..... Company.....

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JOHN CHATILLON & SONS

87 CLIFF STREET, DEPT. IP-7, NEW YORK 7, N. Y.

Manufacturers of Precision Instruments Since 1835

(Continued from page 14)

ature range of minus 20 to plus 225 F, and where flexing does not occur the low limit is below minus 30 F. It contains a high moisture and abrasive resistance and has safe flexing within temperature limits.

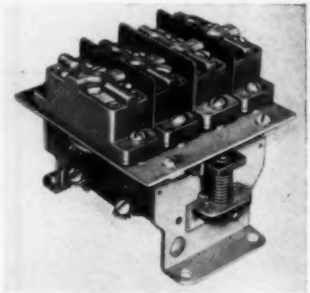
A portable immersion, removable-tip thermocouple has been developed for measuring temperatures of molten steel in foundry holding and transfer ladles. This model is credited with accurate readings in 15 to 25 sec of immersion time in molten steel having a carbon-content of 2.5 per cent or more, through a range from 2400 to 2900 F. Tests indicate that a temperature measurement within 15 F is adequate.

Another development is a 20-gage JX and KX two-conductor insulated extension wire, with standard I.S.A. wire color coding in both iron-constantan and Chromel-Alumel components. Each wire is insulated with enamel, covered by moisture and flame resistant, wax-impregnated asbestos. The two conductors are covered over with a heavy Fiberglas braid.

A one-inch IPS resistant protecting tube is being made as a standard product and for immediate shipment. The new tube has been satisfactorily tested for thermocouple protection in heat treating furnaces, salt and lead hardening baths and gas burners. A temperature of 1800 F is the recommended high measuring temperature for this thermocouple tube.

22—RELAY CAPACITY INCREASED TO FOUR POLES

Announced by the Square D Co., the Class 8501 Type PO4, relay makes available a line formerly obtainable in a maximum of three poles. It is particluarly well suited for control assemblies having all terminals exposed and occupying only a



small space on the panel. There are four normally-open and four normally-closed contacts, allowing the circuit arrangement to be varied by changing the incoming wires to different terminals.

Each of the four snap-action contact mechanisms is self-contained in a melamine case, and may be removed for inspection or replacement by loosening two screws. All contacts are silver-to-silver, rated 10 amp non-inductive with inductive ratings of five amp at 600 v, 15 amp at 110 v. Coils are available for 6-600 v, 25-60 c.

23—VALVE MODULATES FLOW OF BOILER FUEL

The Type L-25R valve, Superior Controls, Inc., is normally closed and opens with steam pressure. It can be set to operate at any desired boiler pressure. Upon reaching the setting, it will open and remain open until the steam pressure drops slightly below the setting point.

For either a gravity or pressurized fuel system, needle valve action makes possible a modulated flow. Steam pressure is controlled by by-passing the fuel oil from the burner to storage tank. The standard ⅛ in. orifice may be increased or decreased to deliver any quantity of fuel desired. Inlet pipe size is ½ in., outlet ¼ in.

24—ANTI-CORROSIVE FOR BOILERS

After years of successful testing within a limited market, an anti-corrosive Corrosanti is now ready for national distribution according to the research laboratory of Dr. Adolph Schror. This material is a scientific boiler and metal protector. As such it is a treatment, which reacts upon the metal treated and not upon the water surrounding the metal. It is manufactured in four grades depending upon the ultimate purpose. Grade A is for the protection of boiler metal surfaces. This preparation removes all boiler scale deposits and eliminates the necessity of any mechanical boiler cleaning device or water softeners. Further rust, pitting and corrosion is prevented. As the old boiler scale is penetrated it enters the pores of the boiler metal automatically sealing them. It is injected into the boiler through the feed line. For high pressure boilers, one pint to a quart per boiler per day injected through the feed line until 5 gal are used is all that is required to remove most of the scale. When inspection proves that the boiler is clean, one pint every second day will maintain a clean boiler at all times.

Grade B is specially prepared for the protection of ferrous metals subjected to deteriorating influences of water and water vapor. Acting as a rust inhibitor it penetrates through rust formations, which cannot be readily removed, causing the rust to flake off. Reaching the bare metal the metal pores are closed, thus preventing further rusting. Applied with a short, stiff-haired brush, it will cling to wet or rusted surfaces and can be applied under water with equal effect.

Grade C is designed for protection of metal surfaces subjected to acid and other highly corrosive vapors, gases, acid-forming conditions, salt water and brines, and is applied in the same way as Grade B.

Corrosanti Special is designed for ferrous surfaces subjected to temperatures of 900 F such as smokestacks, boiler fronts, flues, uptakes and locomotives.

For more information use one of the handy reply cards between pages 92-93. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

25—OIL COOLER CONSERVES WATER

For cooling oil when water is at a premium and/ or waste heat can be used to warm room interiors, a unit oil cooler, manufactured by the Young Radiator Co. is available in nine models, of non-ferrous tube-and-fin construction, guaranteed for use with oil pressures up to 150 lbs. The cooling element is supported in the casing by special spring suspension to eliminate damage from expansion and contraction. The casing is of welded steel construction for ruggedness and freedom from objectionable vibration and noise. The patented

agitator is said to increase heat transfer 100 per cent by breaking up the flow in such a manner that the oil is constantly wiping the tube surface for maximum heat transfer.

26—GAS SAFETY VALVE IS SMALL

Manufactured by General Controls Co., the smallest combination safety and plug valve in the field provides a distinct advantage in the making up of manifold structures. Being a pilot safety valve, the MR-5 "fails" to the "safe" side in the event of a pilot flame failure. The unit is

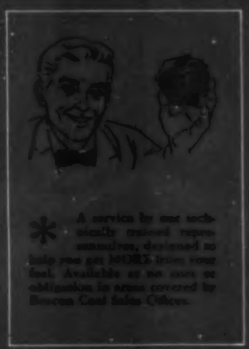
(Continued on page 20)

thinking of

expanding

your boiler house facilities?

maybe Beacon Combustion Service* can help you in your planning



* A service by our technically trained representatives, designed to help you get MORE from your fuel. Available at no cost or obligation in areas covered by Eastern Coal Sales Offices.

Remember—a boiler alone, or combustion equipment alone, *can't generate steam.* It takes boiler *plus* equipment *plus* FUEL to make the system produce. And how well the elements are mated decides how well and how economically your new installation will operate.

In an existing operation . . . the fuel must be fitted to the installation. But in a NEW installation, you may be able to fit the *equipment* to the most desirable fuel—with a saving in money and a boost in output. The Beacon Combustion Service Man will be glad to review possibilities with you.

FOR EXAMPLE: Pre-selection of fuel will let you provide proper combustion space, grate design, etc., that may permit the completely efficient use of lower-cost fuel.

FOR EXAMPLE: Careful study of available coals may let you modify installation details, and fit the system to utilize any of several types, with high efficiency—broadening your source of supply as a hedge against emergencies.

FOR EXAMPLE: Addition of such items as draft gages, and motorized control, CO_2 meters, or similar equipment may frequently be justified many times over by the increase in efficiency.

We can't point out *all* the possibilities—these merely suggest a few. But a conference with the B.C.S. Man will give you all information on available fuels, plus reports on the experience of other engineers with equipment, that will help you make a smart decision.

NOTE TO COAL DEALERS: If any of your commercial or industrial customers or prospects have a problem like this, your B.C.S. Man will be glad to work with you in determining the cause—and recommending a solution.

EASTERN GAS AND FUEL ASSOCIATES

BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

PITTSBURGH BOSTON CHICAGO CLEVELAND DETROIT NEW YORK
NORFOLK PHILADELPHIA SYRACUSE

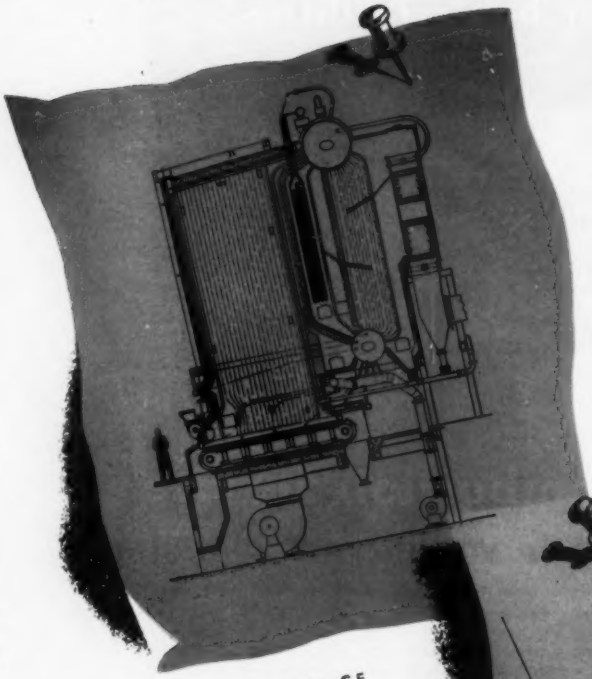
For New England: New England Coal & Coke Co., *For Export:* Castner, Curran & Bullitt, Inc.

They keep coming

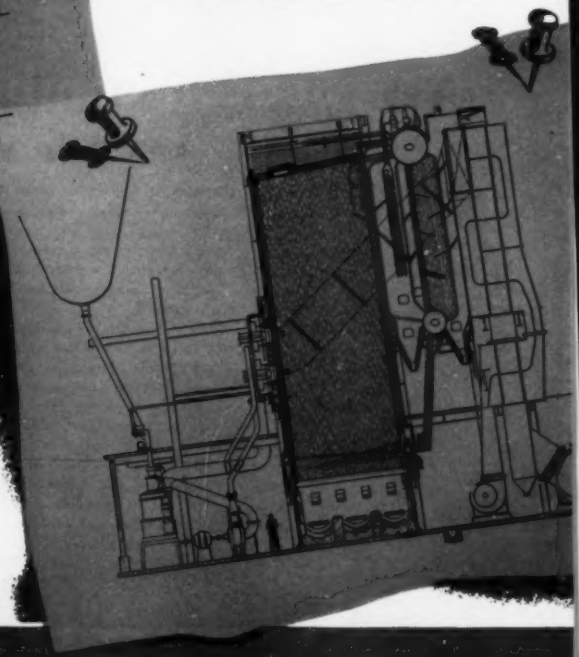
Companies that have bought VU Boilers *continue to buy them.* In fact, a substantial proportion of all VU Units, in service and on order, have been purchased by organizations whose selection reflects their own first-hand experience. *For example* —

A STEEL COMPANY now has a total of eleven VU Boilers in four different plants. Starting with three units in 1936, it has reordered three times... most recently in the fall of last year with an order for three more units.

A TEXTILE MANUFACTURER ordered two VU Units in 1936. Another unit was installed in 1940 and a third in 1944. Still another



VU-50 Unit fired with C-E Spreader Stoker (continuous discharge type). The capacity of unit shown is 80,000 lb steam per hr; operating pressure 425 psi steam temperature 650 F.



VU-50 Unit fired with pulverized coal. The capacity of unit shown is 200,000 lb of steam per hr; operating pressure 560 psi; steam temperature 760 F (VU units are in service for capacities up to 350,000 lb of steam per hr).

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

back for more!

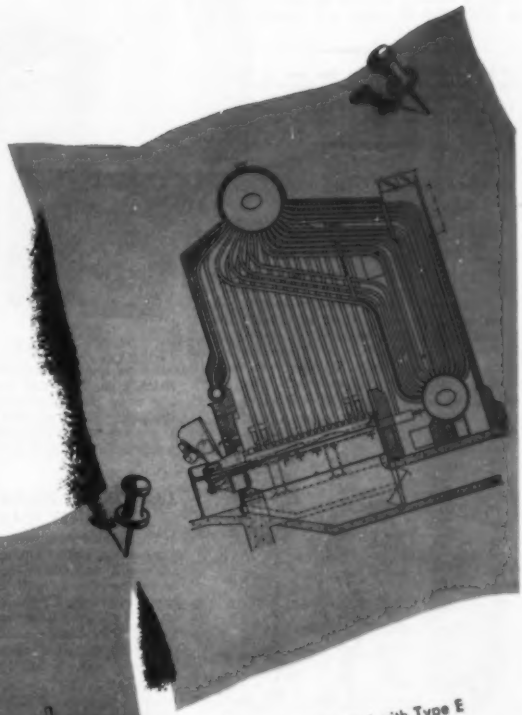
textile company installed one unit in 1945, a second in 1949 and has just ordered another.

A REFINING COMPANY ordered one VU Unit in 1937, another in 1940 and another in 1949 for one of its plants; also two in 1942 and one in 1947 for another plant.

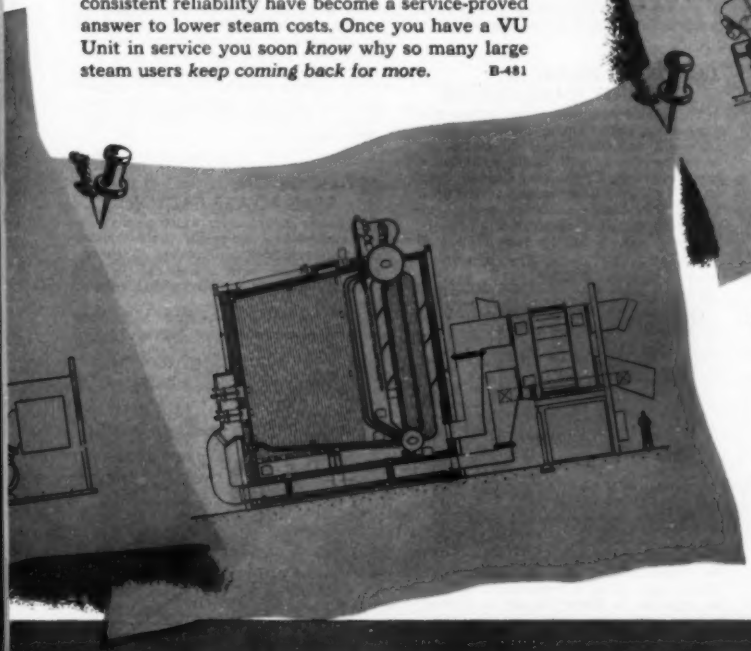
A SEWAGE TREATMENT PLANT in one of America's large cities is another consistent buyer of VU Boilers. Its initial order in 1936 was for two units. Since then it has reordered three times, and now has a total of seven VU Boilers in service.

• • •

The story is the same wherever you go — in all sections of the country American industry is ordering and *reordering* VU Units. Why? Because the VU's advanced design, sound construction and consistent reliability have become a service-proved answer to lower steam costs. Once you have a VU Unit in service you soon *know* why so many large steam users *keep coming back for more.* B-481



VU-10 Unit fired with Type E Stoker. VU-10 Boilers range in capacity from 10,000 to 60,000 lb steam per hr. They may be fired by spreader, underfeed or traveling grate stokers, or by oil or gas.



VU-50 Unit fired with oil or gas. The capacity of unit shown is 175,000 lb of steam per hr; operating pressure 400 psi; no superheat.

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

(Continued from page 16)

a safety shut-off valve, and consists of a thermocouple safety incorporated into a hi-flow gas cock valve structure. Through its use and its lighting cycle, it is impossible to allow passage of gas into the main burner because of its "safe lighting" design.

In applications such as unit heaters, boilers, wall furnaces, water heaters and circulating heaters, it also serves as the manual shut-off valve, as well as the safety shut-off in event of pilot failure.

a safety shut-off valve and consists of a

For more information use one of the handy reply cards between pages 92-93. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

27—MASONRY DRILL HAS REMOVABLE CENTER

Made by New England Carbide Tool Co., this carbide tipped drill bit is designed for precision drilling in concrete, glazed tile or other hard masonry materials using a rotary type drill with pressure applied, for holes ¾ in. diameter and up. Removable Cyclo-Center does away with the necessity of using a wood template to start holes. When inserted, it accurately locates and starts a hole. As soon as hole is spotted, then center is removed. This accessory also does away with walking of the

bit or marring of the surface being drilled. Dust is expelled by machined-in spiral threads running the full length of the body. Bit has a port opening for cleaning core.

28—GROUND ANODES ARE 60 IN. LONG

A 3 x 60 in. graphite ground anode has just been announced by National Carbon Co., a Div. of Union Carbide and Carbon Corp. It provides longer life since there are more pounds of graphite per unit of exposed surface and will stand up to normal installation bumps without damage. The anode is easy to center in the backfill and easy to tamp, is less expensive because money is saved on every rod when ordered in 10,000 lb palletized lots and additional ground installation savings are permitted by its shorter length, which requires less hole to be bored. These graphite ground anodes are recommended for the cathodic protection of pipe lines, tank farms, refinery equipment, electric sub-stations and all sorts of underground and underwater metal structures. They are furnished complete with 36 in. long insulated No. 8 weatherproof cable. Special cables are available for use in refineries or in other oil soaked areas.

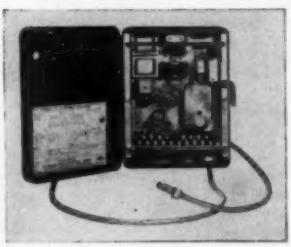
29—SWITCH GUARDS AGAINST AIR FLOW FAILURE

An improved vane type pressure air flow switch for use in forced air cooling of electronic equipment is announced by Coral Designs Div. of The Henry G. Dietz Co. It operates a control relay to guard against tube failure in the event of blower failure or air-passage obstruction. It will operate

on a minimum static pressure of 0.2 in. water gage. Electrical ratings of 5 amp at 250 v a-c are Underwriters' Laboratories approved. The sensitivity is made possible by the use of a vane traveling in a duct and actuating a sensitive snap-action switch.

30—SYSTEM PROTECTS AGAINST FLAME FAILURE

To provide complete flame failure protection and programming control for fully automatic commercial and industrial gas or oil burners as well as for combination gas/oil burners, Combustion Control Corp. offers a system for supervising burner operation. The scanner utilizes a new photoconductive cell which responds to all flames. It "sees" and checks the pilot flame and



the establishment of the main flame, whether gas, oil or a combination of both. Its response to flame failure is positive and instantaneous.

Programming control Type 26RJ8 provides for preliminary purge of the combustion chamber, ignition-on, fuel valve delay, post-ignition timing, and post-purge. Terminal connections are available for directly handling flame failure alarm and modulating motor. Response to flame failure results in complete fuel cut-off in 2 to 4 sec, providing maximum protection from explosion hazards.

31—AIR-FUEL CONTROLLER GIVES FAST RESPONSE

A controller announced by Leeds & Northrup Co. adjusts air flow to fuel flow changes rapidly, yet without cycling. Ap-

plicable to oil or gas firing, or to dual fuel furnaces, it meters both fuel and air flow for maximum accuracy of control. Available for use where ratio control alone is desired. Added speed and sensitivity are obtained with full stability through the use of an improved control circuit identical with that incorporated in the latest L&N temperature control systems. Wide range of proportional band and reset control actions makes it easy to adjust the control to the needs of a furnace. Major sub-assemblies are standardized, readily replaceable. When used with electrically-actuated integrated control, both the temperature control and air-fuel ratio control utilize the same type of plug-in electronic control chassis. When air-actuated control is used, the same type of pneumatic system is built into the pyrometer and ratio controllers.

32—HOOK ON, READ POWER FACTOR

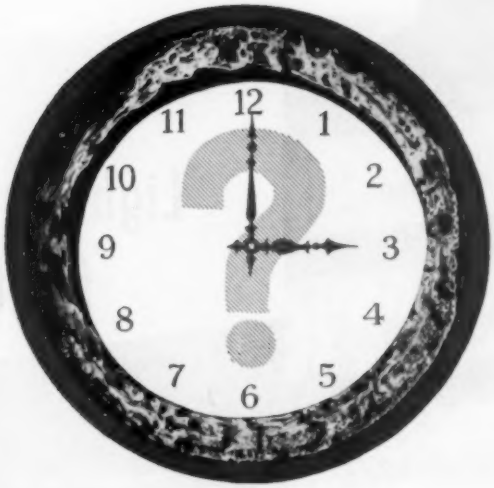
A power-factor meter, which permits direct measurement of power factor without cutting conductors or interrupting electrical service, has been announced by the General Electric Co. Meter and Instrument Div.

The Type AK-3 power-factor meter may be used on any balanced 3-phase circuit.

It gives direct power-factor readings in circuits with voltages ranging from 100 to 600 v and currents from 50 to 600 amp.

The new instrument, a companion to the

(Continued on page 112)



What Time This Month Will Boiler Tube Deposits Shut Down Your Plant?

It can happen *any day . . . any minute.* Deposits may be forming in your boiler tubes *right now . . .* adding layer on layer . . . building up for the failure that is sure to come!

When it does come, you can be sure of one thing. It's going to be expensive! Not only will replacement and installation costs be higher, but you'll also lose valuable production time. And unless your deposit problems are solved, it can happen again and again!

Drew Water Treatment will prevent the formation of deposits. Drew Service protects boilers and power plant equipment with a 3-point program that works! Here's what it does:

1. Drew engineers make a thorough study of plant operations and water problems.
2. Drew water chemists and engineers analyze this data in the modern Drew Laboratories and make specific recommendations for treatment.
3. Drew engineers make periodic service calls at your plant to insure the efficient and economical performance of your water conditioning.

Thoroughness of investigation, proper treatment and frequent service have made Drew one of America's fastest growing water treatment companies. Industry's most respected names avail themselves of Drew Boiler Water Treatment and Service. Do the same. Consult the nearest Drew engineer or write for information.

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Lighting the Way for Progress

Blazing in the night over Racine, Wisconsin, is this dramatic, new 156-foot Research and Development Tower of S. C. Johnson & Son, Inc., world-famous manufacturer of wax products for home, industry and agriculture.

Embodying complete facilities for product research, development and quality study, the building stands as a tribute to the architectural genius of Frank Lloyd Wright and the progressive planning of Johnson's management.

Protecting the Power for Progress

Inherent in the design of the tower is recognition that the researcher needs efficient lighting, flexibility of power supply for his equipment requirements, and uncontaminated air for obtaining true results from his efforts. Power for lighting, motor loads and air conditioning is supplied through a versatile power distribution system planned by Samuel R. Lewis & Associates, Engineers, Chicago. Protecting the system are an I-T-E coordinated outdoor substation, two I-T-E indoor unit substations, and an I-T-E distribution panelboard.

I-T-E Circuit Breaker Company—the center of switchgear progress—is proud of its contribution to the progress of Johnson's Wax.

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new bulletins and catalogs

Be sure to order your free copy of these booklets—they're the latest information published by leading manufacturers. Use the postage-free order cards between Pages 92 & 93. List key numbers of bulletins you want in spaces provided on cards

BOILERS, AUXILIARIES, ACCESSORIES

200—Electrode Steam Boilers. Let Speedylectric put steam to work for you. Designed to hold exact steam pressure and temperature, this line of electrode steam boilers is briefly described in 4-page folder 31. Refers you to bulletin for more specific information. Pressures up to 500 psi and volumes to 750 lb of steam per hr. Livingstone Engineering Co.

201—Oil Valves. Catalog 704A, 4 pages, gives details on oil valves for controlling the flow of oil to industrial oil burners. Discusses the precise metering feature which is helpful in preventing smoke by avoiding excess amount of oil. Hauck Mfg. Co.

202—Over-Fire Air Systems. "Burn the smoke" for cleaner, more efficient coal heating, says Canton Stoker and then shows how it's done in 8-page bulletin on Turbo-Aire over-fire air systems. Contains thorough discussion on principles of combustion and smoke elimination. Gives full description of the equipment along with cutaway and diagrammatic views showing units in action. Selection chart, specifications, and fan data and characteristics are included as is brief description of automatic controls. Three types of stokers are illustrated and short descriptions given. Canton Stoker Corp.

203—Package Steam Generator. Completely assembled unit—finished, tested and certified at the factory—is illustrated and described in 6-page bulletin B3100. Lists features and contains a great deal of information in tabular form. Side and end view drawings of the fully-automatic 3-pass forced draft unit show placement of components. The Titusville Iron Works Co., Div. of Struthers Wells Corp.

204—Gas Burner Nozzles. Advantages of combining flame retaining nozzle and long sweep elbow into single unit are listed in 2-page catalog 804B. Sketch shows how discharge orifice is displaced outwardly from center line of curvature of elbow. The nozzle is said to operate with lower manifold pressure without back firing. Hauck Mfg. Co.

205—Refractories & Insulations. Catalogs R52 through 192, compiled in binder, make a 40-page booklet that tells the whole story of refractories and insulations. Shows where, when and how to use the various types of materials in industrial heat generating and processing equipment of all kinds. Of particular interest is table showing how to select proper thickness of insulating material. Contains helpful suggestions that should aid in solving refractory and insulation problems. Refractory & Insulation Corp.

206—Fuel Oil Heaters. For heating heavy grades of fuel oil with automatic control of oil temperature, Hauck offers its electric oil heaters. Catalog 709, 4 pages, gives complete data on the units. Advantages, methods of automatic operation, recommendations, and sizes are listed. Includes table on oil heating rates. Hauck Mfg. Co.

207—Oil Burning Manual. Informative 4-page manual should be valuable guide for proper installation and operation of oil-burning equipment. Includes among the 20 selected headings such important tables as "Air Flow Through Airports". "Available Draft", "Excess Air", "Boiler Pressure & Flue Gas Temperature". Cleveland Fuel Equipment Co.

208—Insulating Material. Kaylo calcium silicate products and their various uses are described fully in 24-page booklet. Part of the booklet is devoted to research and development history of hydrous calcium silicate products and description of its properties. Also outlines the various advantages of laminated panels and firedoors. Gives list of uses including heat insulation. Kaylo Div., Owens-Illinois Glass Co.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

209—Compressors. Heavy-duty, crosshead type, 100 psi, two-stage air compressor in sizes from 125 to 350 hp is illustrated and described in 20-page bulletin 3150. Gives full details on design, ratings, lubrication, controls, capacity and motor drive. Cross sections illustrate the many engineering features and construction advantages. Exploded photos show bearing and crank shaft assembly and lubrication system. On-the-job photos included. Ingersoll-Rand Co.

210—Diesel Engine, Medium-speed, heavy-duty continuous service engine with 3, 4, 5, 6, 7 and 8 cylinders, rating from 225 to 600 bhp at 720 rpm is illustrated and described in 36-page bulletin 10,310A. Full discussion on injection system and other design features is contained. Gives installation and maintenance data along with information on lubrication, cooling and starting systems. Specifications, ratings, dimensions shown in diagrammatic and tabular form. Typical applications and installation photos included. Ingersoll-Rand Co.

211-Gas Turbine. Two-color 16-page booklet GEA5530 on gas turbine for pipeline pumping describes the features of the equipment, its application and operation. Illustrated with photographs, line drawings, and charts showing hp limits for various ambient temperatures. Breakdown chart showing components of the turbine is included as well as sketches showing typical installation buildings. Gas turbine control, remote supervisory control, and accessories are also listed. General Electric Co.

HEAT EXCHANGERS

212—Waste Heat Recovery. Illustrated 4-page bulletin covers utilization of unit heaters for recovery and distribution of waste heat from engine and compressor jacket water. Method of using waste heat to lower space heating costs is fully explained. Several installations are detailed to show piping hook-ups and control methods. Tells how to select correct unit heater size and type and gives typical example illustrating calculations. Performance tables show basic hot water capacities of the units. Modine Mfg. Co.

213—Unit Oil Coolers. Catalog 3550 on unit oil coolers gives design features, physical dimension data, etc. Recommended for oil cooling where cooling water is scarce and/or the waste heat can be utilized to warm room interiors, according to the booklet. Non-ferrous tube and fin type and available in nine sizes. Young Radiator Co.

214—Heat Exchangers. Bulletin ID151 illustrates wide variety of specialized heat transfer surfaces which have been developed for industrial use. Surfaces shown are applicable to such equipment as solvent recovery, intercooling, regeneration, gas separation and liquefaction, heat economizing and drying. Included are types providing as much as 300 to 350 sq ft of surface per cu ft of volume. Engineered to meet the specific requirements of individual applications and are manufactured only in large quantities. Modine Mfg. Co.

WATER AND LIQUID TREATMENT

215—Water Softeners. Publication 3000 is a 68-page booklet describing and illustrating hot process softeners. Although recommending that each boiler plant should be studied carefully in conjunction with the available water to select the type of treatment and equipment best suited, the catalog discusses variations in the treatments that may be applied. Shows some of the designs that are available and have been

(Continued on page 26)

SMOOTH running

Condor V-BELTS

"Smoothest running V-Belts we've ever had," users say. "... and they smooth out our production problems, too!"

Smooth running is no accident in Condor Whipcord V-Belts. For example, we micro-position the pulling section so that it stays in the neutral axis area, where engineering practice says it should be. With every belt so precision-made, a Condor Multiple V-Belt drive is bound to be a smooth running team.

Bulletin 6868 D, mailed on request, describes all advantages to you of Condor Whipcord V-Belts.

You'll find this same good engineering also in our hose, flat belting and conveyor belts. Just phone your R/M Distributor.

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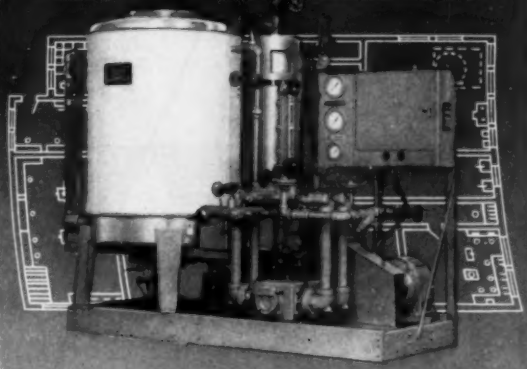

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FORCED RECIRCULATION
STEAM GENERATORS

Plan your steam plant for long range economy and realize immediate savings on installation and operating costs.

The Clayton *Forced Recirculation* Steam Generator...in sizes from 15 to 100 h.p., and equipped to burn gas or oil, or both...is a compact, self-contained steam plant ready to install and operate as it is delivered. No accessories to buy. No stack, bricking or foundations to install. Move into place; connect fuel and water lines, electricity and vent, and the Clayton generator is ready to operate. Occupies 30% to 70% less space than conventional boilers of same capacity.

Within 5 minutes from a cold start, the Clayton generator attains full operating pressure. Any fluctuating load demand within its rated capacity is instantly and automatically met. No standby losses. High thermal efficiency cuts fuel costs in half, or better. On gas fired units, new electronic safety control proves the flame pilot; automatically shuts down plant on ignition failure or loss of fire. Clayton generators are built to conform to the A.S.M.E. Boiler Code, and are Hartford inspected. Send the coupon for complete catalog.

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Send name of nearest distributor and arrange desk demonstration of Clayton *Forced Recirculation* principle. Send catalog.

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Animated flow chart shows how Forced Recirculation principle cuts steam costs.

(Continued from page 24)

successfully applied in practice. Cochrane Corp.

216—Water Treatment & Conditioning. Booklet 501, 16 pages, gives considerable technical data and describes services, products and methods employed in solving the many water problems encountered in industry. Treatments for boiler water, water lines, cooling water systems, brine systems, and waste water are all thoroughly covered. Included is a study of ten impurities common in water, the damage they cause and how to combat them. Brooks Chemicals, Inc.

217—Industrial Waste Treatment. "Four Ways to Economize on Industrial Wastes" is a 4-page technical paper that gives four steps in treating industrial waste. Deals with waste treatment in a general way and offers many suggestions that should be helpful. Gilbert Associates, Inc.

FILTERS, STRAINERS, CLARIFIERS, DEHYDRATORS

218—Underdrain System. Bulletin 5128, 4 pages, gives particulars on baffle plate type of underdrain system for purifying water. Said to be non-clogging and to provide even back-wash distribution. Cutaway views show how the system works. General Filter Co.

For more information use one of the handy reply cards between pages 92-93. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

219—Oil Purifiers. Savings in oil consumption and equipment operating and maintenance costs in quenching, hydraulic and metal working operations are described in three 4-page illustrated bulletins. Actual quench oil purification problems and their solutions are discussed in one bulletin. Explains how installation of oil purification equipment has prolonged useful life of the oil, greatly extended periods between cleaning operations, and substantially reduced equipment downtime. Another bulletin tells how plants of all sizes have eliminated downtime, mechanical failures and expensive repairs on hydraulic equipment with hydraulic oil purifiers. Shows correct method and equipment used to keep hydraulic oil clear, clean and safe for use indefinitely. Third bulletin describes new magnetic filter; shows how unit removes contaminants from liquid coolant. Case history briefs further illustrate application of filtration equipment to various operations. Honan-Crane Corp.

ELECTRICAL EQUIPMENT

220—Voltage Regulators. Bulletin S3-51, 12 pages, features complete line of standard Stabiline automatic voltage regulators. Describes in detail the workings in maintaining constant output voltage regardless of fluctuations in a-c input line voltages and changes in output load. Standard models of both instantaneous electronic and electro mechanical types are discussed. Illustrates each unit together with outline drawings and performance data. Com-

plete rating chart provides engineering information for ease in selecting units for specific applications. The Superior Electric Co.

221—Circuit Breaker Panelboards. Circuit breaker panelboards for the control and protection of power applications—and the circuits that supply them—are described in 20-page booklet B5260. Describes circuit breakers for a complete range of industrial requirements, in capacities from 10 to 600 amp. Says that features of the breakers are service continuity protection, protection to personnel, and no replacement costs. Westinghouse Electric Corp.

222—Carbon Brushes. Bulletin GEA 5597, entitled "Carbon Brushes for Electric Equipment", describes and illustrates the fundamental considerations given to the design, application, and manufacture of carbon brushes and includes a section on brush terminology. Produced to familiarize users with the physical characteristics that must be known before proper recommendation can be made for a brush application, the 28-page booklet also tells of the engineering services offered to help solve specific brush problems. Included are sections on types of brushes, characteristics of brush grades, brush grade recommendations, mechanical design of brushes, and tips on brush replacement. General Electric Co.

223—Electrical Fittings. Complete line of solderless wire connectors, cable and conduit fittings, and wiring devices are described in 12-page catalog 1050. Contains illustrated descriptive information on solderless wire splicing and terminating, plain and insulated conduit bushings, box connectors for metallic and non-metallic sheathed cables, conduit locknuts, etc. Includes complete specifications, dimensional data, and application instructions. Buchanan Electrical Products Corp.

224—Bus Duct Manual. Booklet B-4272A, 68 pages, describes types of bus duct and accessories available, and presents application and test data, specifications, information on pricing a typical bus duct installation, and a typical bill of materials. Lists advantages of bus duct for secondary power distribution system, and tells where bus duct can be used and specific advantages it offers. Illustrations include sketches showing dimensions of two-, three-, and four-wire bus duct. Technical section presents useful data, tables, and formulas along with voltage drop curves for low-impedance bus duct. Concludes with test data on plug-in bus duct and short-circuit stresses. Please use your company letterhead in requesting this manual. Westinghouse Electric Corp. Box 2099, Pittsburgh 30, Pa.

225—Transformers. Current, potential and metering transformers are the subject of 32-page illustrated bulletin S501B. Packed with technical information in the form of detailed drawings, accuracy limits, ratio and phase angle curves. Should be an aid to anyone working with instrument transformers. The Standard Transformer Co.

226—Specialty Transformers. Facilities for producing specialty transformers

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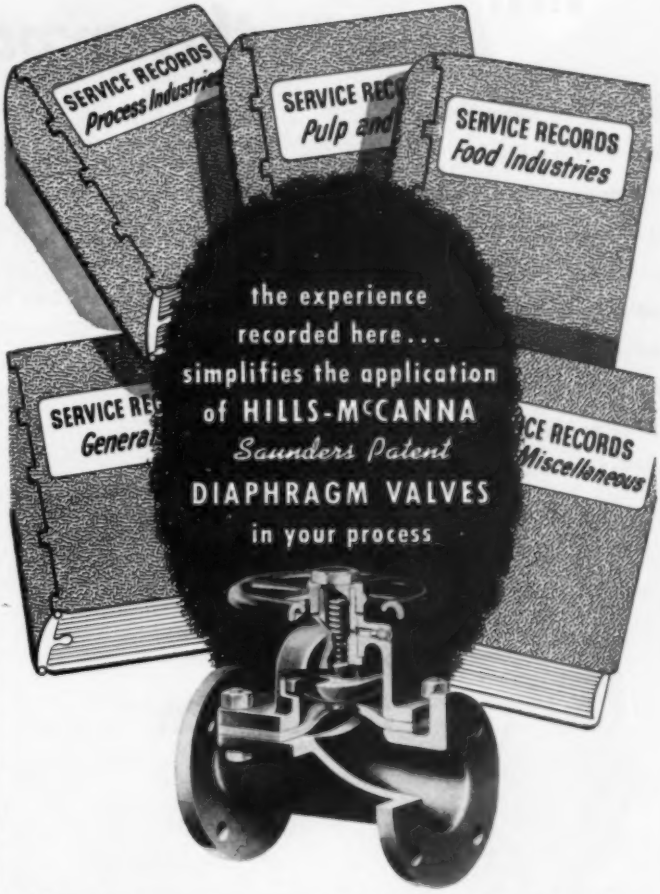

If you are conveying corrosive or hard-to-handle fluids, a Saunders Patent Diaphragm Valve may be the answer to your valving problems. If so, the experience recorded in the five volumes illustrated above is your best assurance of getting the *right* valve for your needs. In these records are body and diaphragm material recommendations for handling some 2500 substances, based on Hills-McCanna's nearly 20 years' experience in the manufacture and application of Saunders Patent Valves. If you have a tough valving problem, let this "know-how" work for you.

Hills-McCanna Saunders Patent Diaphragm Valves are made in sizes from ⅜" to 14" for manual, automatic or remote operation with a choice of 13 diaphragm materials and 48 body materials. Write for complete information. HILLS-McCANNA CO., 2355 W. Nelson St., Chicago 18, Ill.

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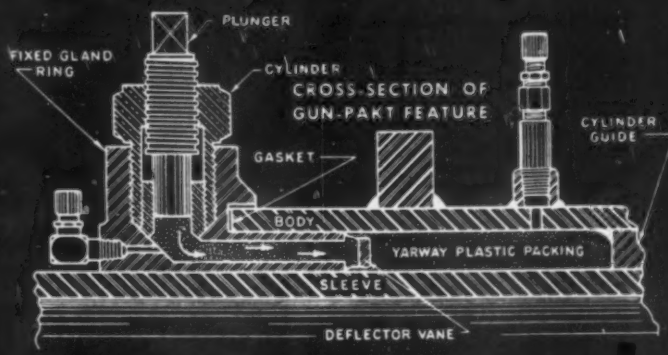
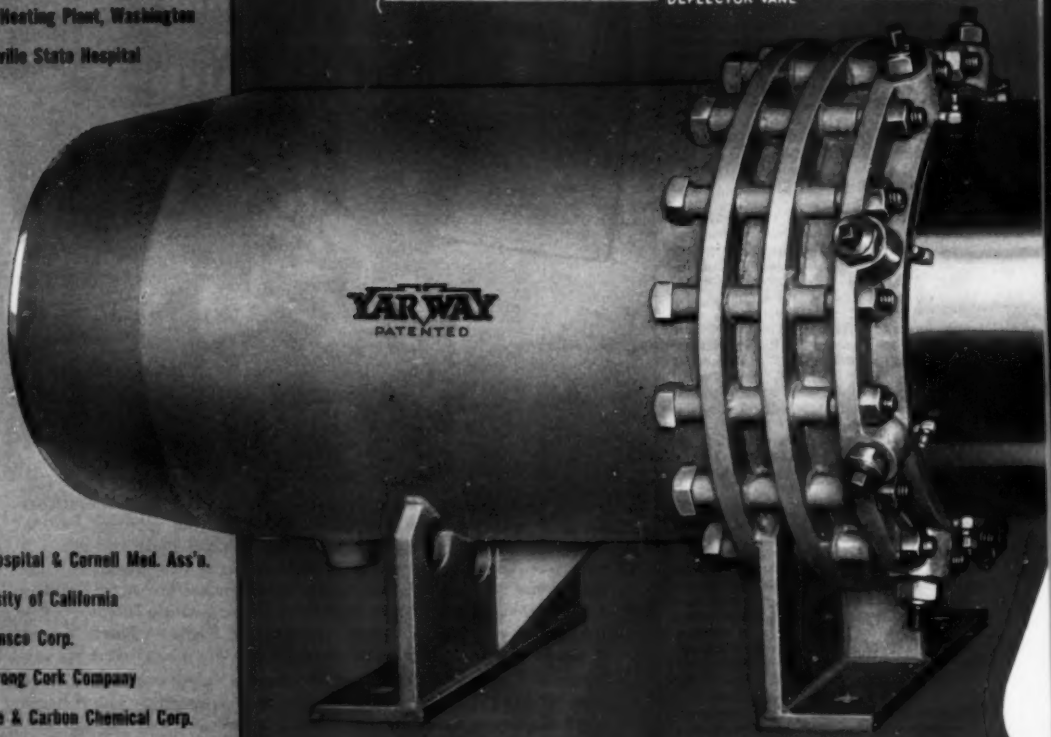
University of California
Agfa Ansco Corp.
Armstrong Cork Company
Carbide & Carbon Chemical Corp.
Chrysler Corp.
General Motors Corp. (Buick Div.)
General Motors Corp. (Chevrolet Div.)
Westinghouse Electric Co.
West Central Heating Plant, Wash., D.C.
University of Washington
Public Service Company of Colorado

this expansion joint





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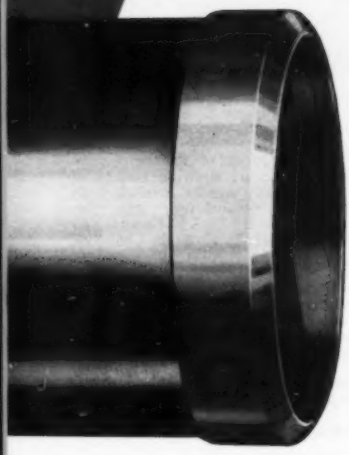

Yarway Single-end Gun-Pakt Expansion Joint, welding type. Double-end and flanged types also available.

What feature do you want most in an expansion joint . . . sure movement, simplified installation, ease of servicing, low cost, low upkeep?

Yes, they're all important. But when you're dealing with steam under pressure, *there's nothing more important than reliability—freedom from shutdowns.*

The high factor of safety in Yarway Gun-Pakt Expansion Joints prevents shutdown losses—eliminates accident hazards.

Gun-Pakt Joints are *rugged* joints, strong and dependable. They are *serviced under full steam pressure.* Packing is added simply by inserting a plug of Yarway plastic packing and turning a wrench . . . the joint's tight, the job done.

FEWER JOINTS NEEDED

With Yarway Gun-Pakt Joints you need fewer joints per length of pipe line. Each sliding sleeve may have a traverse of either 4″, 8″ or 12″ . . . maximum expansion being 24″ for a double-end joint.

Gun-Pakt is more than just another expansion joint—it is a revolutionary idea in expansion joint engineering. Its success is shown by wide use in leading [illegible] stations, institutions and [illegible] plants.

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A SHORT STATEMENT ON

STEAM TRAPS

THAT IS LONG ON GOOD SENSE:

A Steam Trap has but *one* function—to drain condensate from steam lines. Right?

Now if one brand of Steam Trap can drain *twice* as much condensate $ $ = $ under equal conditions, as another of the same size and price—it's just plain common sense to buy that brand, isn't it?

Clark DUO-STEP LEVERAGE STEAM TRAPS have proved in tests time and time again that they *can* drain *twice* the condensate of ordinary traps.

So—do as thousands of smart steam engineers have done:

SWITCH TO CLARK DUO-STEP STEAM TRAPS FOR DOUBLE DRAINAGE EFFICIENCY!

THE CLARK MANUFACTURING COMPANY
1846 East 38th St. • Cleveland 14, Ohio

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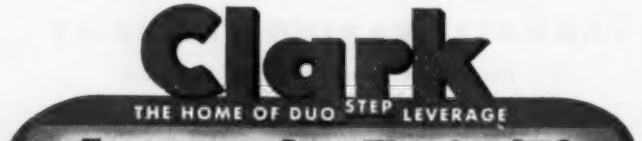

The complete line of dependable fluid controls

(Continued from page 27)

are described in 24-page brochure. Constant voltage transformers, lighting transformers, and specialty air cooled transformers, which are used in a wide variety of applications are pictured and described. Sola Electric Co.

227—Manual Starting Switches. Manual starting switch for fractional horsepower motors is featured in 8-page bulletin 600. Describes the switch in detail and is illustrated with photographs of typical installations. Also contains complete dimensional and engineering data, describes and illustrates features of each of the six models. Allen-Bradley Co.

228—Power Factor Visualizer. Prepared in the form of a slide-rule-type chart, the power factor visualizer (SA6739) makes it possible to follow a hypothetical case involving low power factor and shows how the installation of capacitors can solve this, as well as many similar problems. The chart explains just what low power factor is, what it means to both the power user and the power supplier, and what benefits can be obtained by improving the power factor in industrial distribution systems through the installation of capacitors. Westinghouse Electric Corp.

229—TEFC Motors. Bulletin O5B715-OA describes types of construction and ratings of totally-enclosed, fan-cooled motors with tube-type, air-to-air heat exchangers. Included in the 6-page bulletin is a chart showing ratings of totally-enclosed motors available in squirrel-cage, wound-rotor and synchronous types for both horizontal and vertical installation. Allis-Chalmers Mfg. Co.

230—Generator Controls. Bulletin GEA 5628 deals with 28-v generator control systems for multi-engined aircraft. The 8-page publication deals with a centralized system and shows how protection is provided against overvoltage, ground fault, reverse current and undervoltage. General Electric Co.

INSTRUMENTS, CONTROLS, RECORDERS

231—Draft & Low Pressure Instruments. Fully indexed, 20-page bulletin 51-667 describes and pictures line of draft and low pressure instruments. Discusses indicators (of seven types), recorders, and controllers. Application table is included to aid in selecting the correct instrument. Features such as calibrating springs, diaphragm units, and differential valve assemblies are explained. Size, scales, ranges, cases etc., of each instrument are illustrated and discussed. In addition, 14 types of draft and pressure, differential and other measuring elements are pictured. The Hays Corp.

232—Industrial Thermometers. Bulletin G143B describes and illustrates dial type temperature indicating and recording thermometers. The 8-page booklet shows the wide variety of dial ranges, types of fittings and direct or distant mountings available. Typical applications are listed as are specifications. The Electric Auto-Lite Co., Instrument and Gauge Div.

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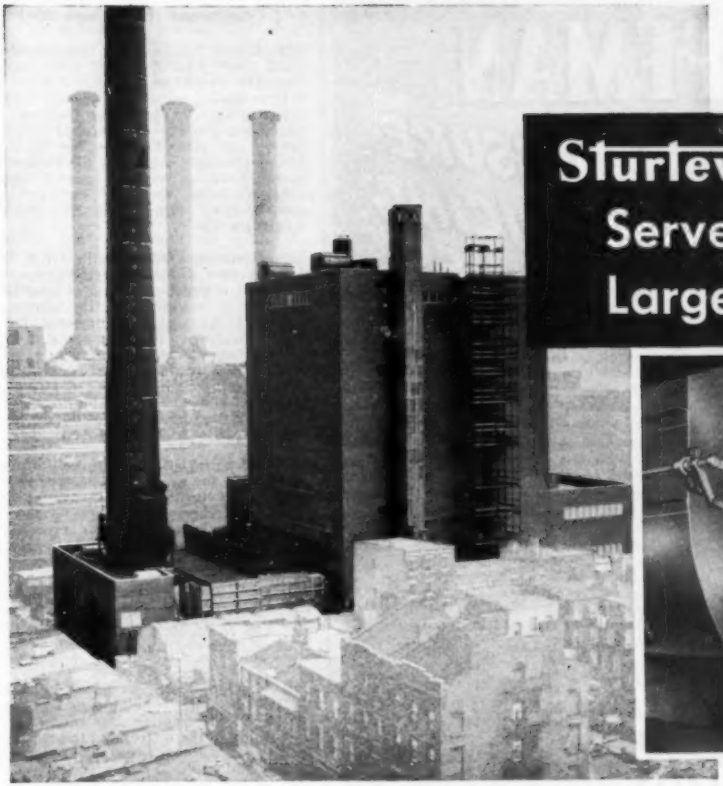
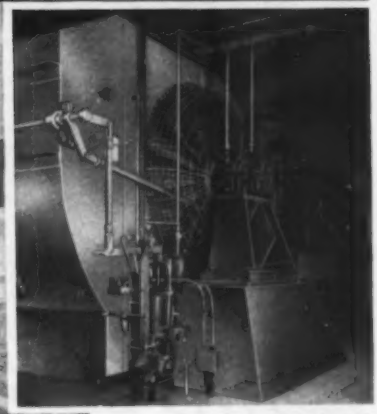


Home of the world's largest boiler—Consolidated Edison's Hudson Avenue Station, Brooklyn, N. Y.

Sturtevant FANS Serve World's Largest Boiler



One of the TURBOVANE® Forced Draft Fans, showing its VANE CONTROL® mechanism.

Rated at 1,300,000 lbs. of steam per hour, the *largest* boiler now in operation required the most *dependable* Mechanical Draft equipment available.

Since December 15, 1950, when it went "on the line", Sturtevant fans have been on the job supplying the air necessary for 24-hour boiler operation. Two Sturtevant Forced Draft Fans deliver 200,000 cfm at 11" static pressure. They are teamed with two Sturtevant Erosion-Resisting Induced Draft Fans, drawing 350,000 cfm at 16.3" static pressure and 300°F. Both Forced Draft and Induced Draft Fans are equipped with Sturtevant power-saving Vane Control.

Dependability and performance are outstanding features for which Sturtevant Mechanical Draft equipment have long been selected for central stations and industrial power plants. If you want to *put air to work* efficiently and economically, contact your nearest Sturtevant Office, or write to Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S **Westinghouse**

PUTTING *Air* TO WORK

J-80225

HOFFMAN TRAPS VALVES PUMPS

HOFFMAN SPECIALTY CO., 1001 YORK ST., Dept. IP-8, INDIANAPOLIS 7, IND.
Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems.
Sold by leading wholesalers of Heating and Plumbing Equipment.

(Continued from page 30)

233—Rotor Temperature Instruments. Data sheet 9.1-7 describes strip chart recorder which when coupled with a Kelvin bridge measuring circuit, comprises method of measuring rotor temperatures. Describes method of installation, and also discusses the Kelvin bridge principle. Also lists the required instrumentation, system benefits and other technical data. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

234—Dynamometer. Bulletin GEA 5-552 presents 250-v d-c dynamometers for direct connection testing of internal combustion engines, electric motors, pumps, blowers, and compressors. Describes features of the equipment, its applications and operation. Illustrated with actual installation photographs, table of full-load hp and speed ratings, and chart showing typical performance curves. Dynamometer control and accessories listed. General Electric Co.

235—Industrial Meters. Bulletin OG-400 aids in the proper selection of meters for measuring more than 200 liquids with varying corrosive characteristics. Included are data on liquids running from absorption oil to zinc chloride. Units range in size from ½ to 3 in.; measure in gallons, Imperial gallons, barrels, or liters; have totalizer capacity of up to seven figures; and are available in six types of registers. Also includes simplified specification sheet. Rockwell Mfg. Co.

236—Running-Time Recorder. Bulletin OP1504 describes running-time recorders. Gives information concerning the application of the instrument to presses, factory machinery, refrigerators, pumps and motors, conveyers, continuous ovens, furnaces, etc. Liberally illustrated with photos of various models, reproductions of chart records, and operation drawings. Photographs of several installations also included. In addition, brief descriptions of other recorders are given. The Bristol Co.

237—Humidity Control Instruments. Data sheet 10.5-4 describes method of humidity measurement that makes possible direct readings from remote locations. Includes photos of units along with diagrams showing applications in typical air-conditioning systems. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

238—Pyrometer. Two portable pyrometer models are described in bulletin PPY-1. Useful where temperatures of molten aluminum, zinc, lead, tin, brass and other non-ferrous alloys must be measured before pouring; where liquids must be held to correct tempertures to assure proper consistancy; and where temperatures of metals in galvanizing kettles must be maintained to provide uniformity in coating etc. Specifications on thermocouple holders and tips are also contained in the 2-page sheet. Wheelco Instruments Co.

239—Solenoid Valves. Direct operated solenoid valves are covered in 8-page catalog V. Lists sizes from ¼ to 3 in.; valves for normally open or normally closed service; stainless steel or Jenkins disc seats; valves with special dashpot construction to stop water hammer;

3-way solenoid valves, etc. All are built for pressures up to 150 lbs, quick-opening and free of any pilot valves or auxiliary pistons, it is stated. Shows drawings of many typical installations. The Johnson Corp.

240—Combustion Meter. Information on automatic CO_2 recorder is contained in 4-page condensed bulletin 51-553. Covers application and description of the orsat principle of operation, complete with detailed schematic drawing. Such features as temperature compensation and self leveling are explained; installation and sampling are illustrated and described. Handy selector chart included. The Hays Corp.

For more information use one of the handy reply cards between pages 92-93. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

241—Function Plotter. Instrument which automatically plots one variable in terms of another is described in 4-page data sheet 10.0-5. The instrument records the relationship between two variables, showing one as a function of the other. The data sheet gives numerous applications for which the instrument is suited. It further describes the operation and instrument characteristics and gives other essential technical data. Minneapolis-Honeywell Regulator Co., Brown Instruments Div.

242—Multipoint Chart Recorder. Bulletin MPCI explains how up to six permanent records of industrial processes may be obtained on one strip chart. The accuracy of deflection type measuring circuit, electronic link and simple chart printing mechanism used in the instrument are described. An open view illustrates arrangement of the basic recorder assemblies. Gives specifications. Wheelco Instruments Co.

243—Miniature Speed Changer. Technical data sheet 4B describes miniature variable-ratio speed changer with lever adjustment. Diagram shows dimensions of the instrument as well as adjustments possible with the lever. Applications include all low power devices. Metron Instrument Co.

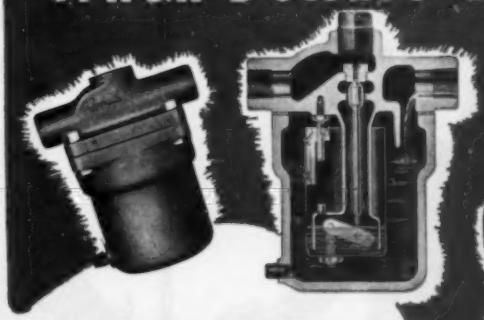
244—Potentiometer Controller. Engineering specifications of strip chart pneumatic control potentiometer are given in 2-page specification sheet 175. Advantages of pneumatic control combined with strip chart instrument are explained in detail. Specifications are included. Minneapolis-Honeywell Regulator Co., Brown Instrument Div.

BULK HANDLING EQUIPMENT

245—Woven Wire Conveyer Belts. Catalog 31 contains 40 pages of illustrated standard and special types of wire belting weaves with specifications and detailed descriptions. Power formulas and construction details are covered fully, as well as suggestions for prolonging belt life and increasing efficiency. Also covers complete conveyer systems. Korb-Pettit Wire Fabrics & Iron Works, Inc.

(Continued on page 114)

When Dollars Count



-63 "Master" Type 0-300 psig.

-71 Steel 0-300 psig.

-101 "Steel" Type 0-700 psig.

"AIRXPEL" STEAM TRAP *Proves Its Value*

The only true test of steam trap VALUE is what the trap does AFTER it's installed.

Re-orders through the years are tangible proof that both engineers and maintenance men, as well as dollar-minded executives, like "AIRXPEL" traps—because these traps can be connected into the line and forgotten—whether the load is light or heavy, pulsating or non-pulsating, continuous or intermittent. STRAIGHT-THROUGH connections are an appreciated convenience, too. Instances of more than 20 years of uninterrupted service life are not uncommon.

Removing both AIR and CONDENSATE from steam lines in some of the largest industrial plants in the world—in vessels of the U. S. Navy and other maritime services—and in small low pressures systems, "AIRXPEL" has come to be the accepted standard of performance for open bucket steam traps. The principle of operation—its efficiency and economy, have been proven to the satisfaction of the most skeptical.

"AIRXPEL" steam traps in sizes up to 2 inches and pressures to 700 psig. Capacities to 34,500 pounds of water per hour. Complete specifications and application data in Catalog 600 help you select size and type best suited for your needs.

Send for this Catalog

WRIGHT-AUSTIN COMPANY
3233 Wright St. Detroit 7, Mich.

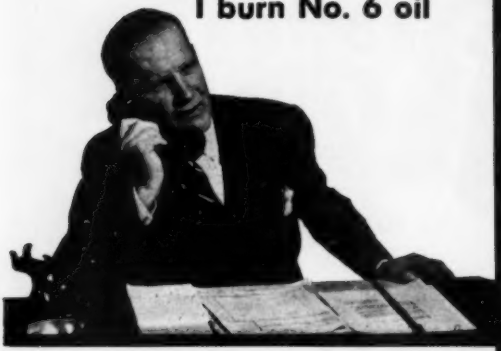
WA Standard since STEAM USERS SINCE '94

WRIGHT-AUSTIN

SERVING INDUSTRY FOR MORE THAN 50 YEARS

1.

That's right!
I burn No. 6 oil

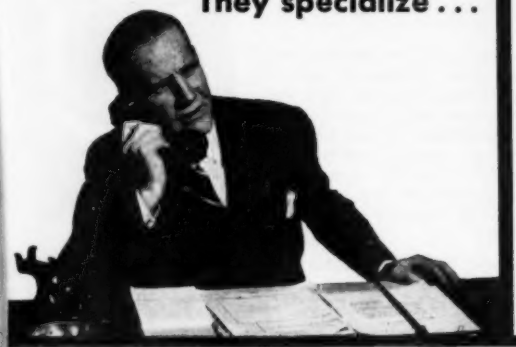


2.

No, not a bit of trouble!

3.

Yes, it's a Preferred.
They specialize . . .



4.

. . . in fully*automatic operation with residual fuels!

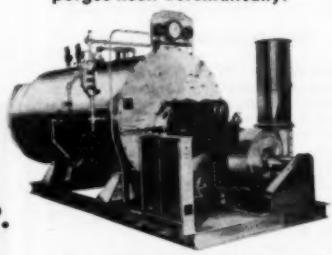
That plant engineer is only one of hundreds who label us specialists in *fully* automatic operation with residual oils. We're proud of the title, of course, for we achieved what many folks said couldn't be done. But, actually, we at Preferred like to be thought of as all-around experts in combustion problems. Witness the complete Preferred line of gas, combination oil-and-gas and light oil-fired steam generators.

We tackled and solved the problem of residual oils, because we knew we could cut your production costs by $3,000 to $35,000 a year by reducing fuel costs. Scores of Preferred customers have already pocketed these savings. Like the engineer on the 'phone, they are burning No. 6 oil with *fully* *automatic operation.

If you are now using more expensive grades of fuel, discuss your installation with a Preferred representative or write for Bulletin 175 about the Preferred Horizontal Rotary Oil Burner and Bulletin 1000 which describes the Preferred Unit Steam Generator.

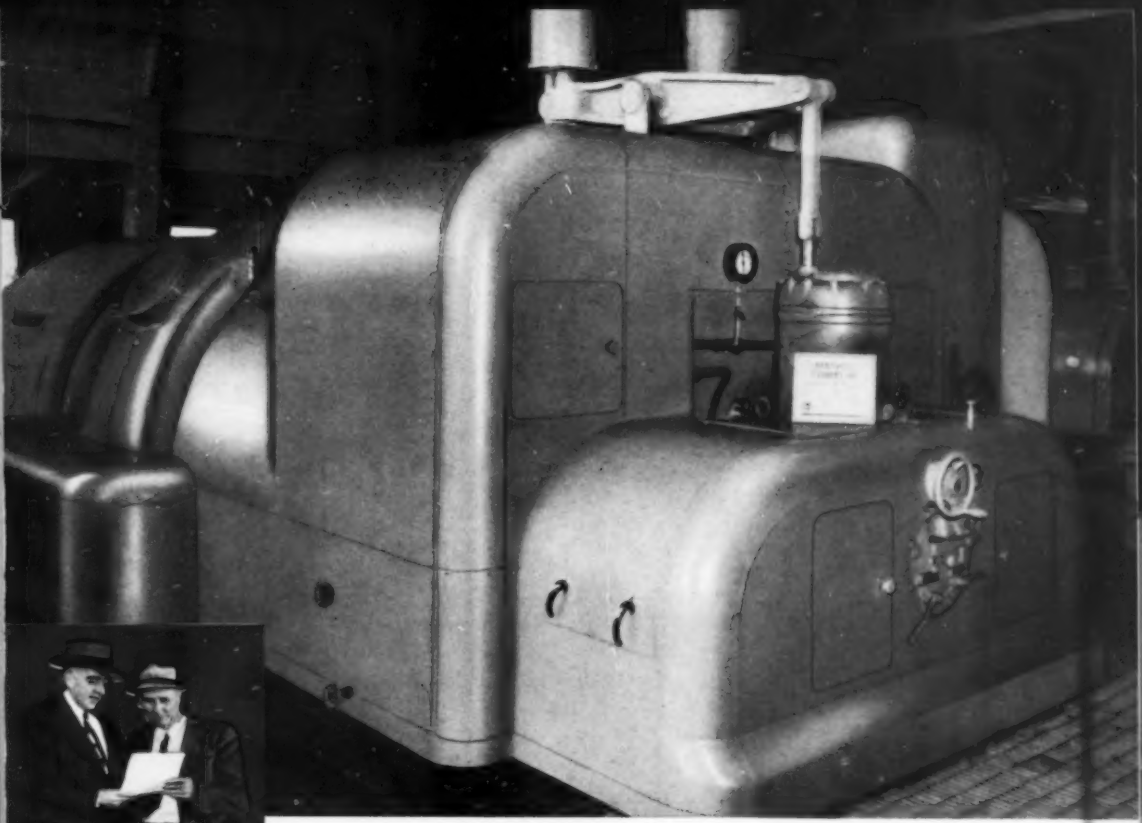
*What We Mean By *Fully Automatic* Operation

- **Starts *automatically***
- **Ignites *automatically***
- **Starts at low fire and follows load *automatically***
- **Shuts off, cleans and purges itself *automatically*.**



PREFERRED UTILITIES MANUFACTURING CORP.
1860 BROADWAY, NEW YORK 23, N. Y.

PR-206



One (good) thing leads to another

at Coffeyville, Kansas

Al Manis, superintendent of the Coffeyville municipal power plant, and Standard Oil (Indiana) lubrication specialist Thomas R. Smith, review the latest report on NONPAREIL Turbine Oil in service in the 10,000-KW turbine above. The neutralization number: 0.04 mg. KOH/gm.

Low acidity was one of the advantages Coffeyville engineers counted on in specifying NONPAREIL when this turbine was installed in June, 1949. NONPAREIL already had shown its resistance to deterioration, its freedom from deposits, and its elimination of acidity troubles, in the municipality's 5,000-KW turbine where it has been in service since 1945. The performance record on this first unit . . . a record including no oil replacement, no necessity to remove the oil for treatment, no downtime for cleaning of the oil system . . . was reason enough for insisting on NONPAREIL in the second turbine.

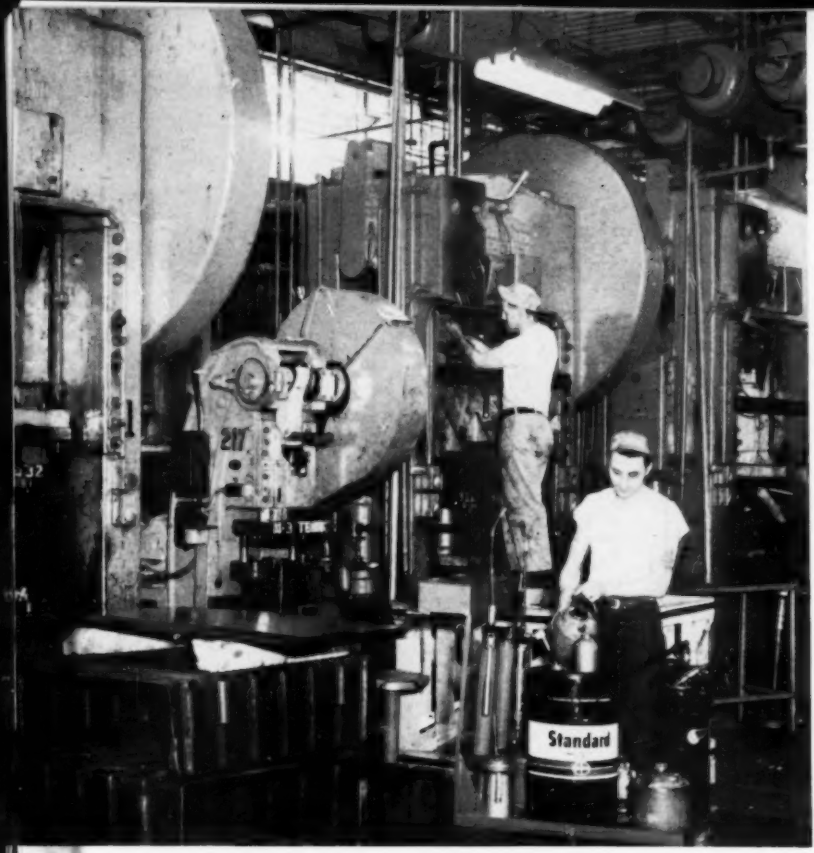
Consider what a similar lubrication performance record can mean to your own operating and maintenance costs. Consider too, that NONPAREIL Turbine Oil is guaranteed in writing to last as long as your turbine. Its neutralization number is guaranteed never to exceed 0.15 mg. KOH/gm.

For details on NONPAREIL Turbine Oil as applied to your turbine installation, and case studies showing the results of up to 23 years continuous trouble-free operation of NONPAREIL in other installations, call for the services of your Standard Oil lubrication specialist. You can reach him at your local Standard Oil Company (Indiana) office, or write: Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

NONPAREIL
TRADE MARK
Turbine Oil

STANDARD OIL COMPANY (INDIANA)

STANDARD



No drips in this press room

WHEN plant engineers at the A. O. Smith Corporation Kankakee Works tested STANODRIP Dripless Oil No. 59 on the recommendation of a Standard Oil lubrication specialist, they found the solution for press room lubrication troubles.

STANODRIP ended the drippage of oil from bearings on stamping and punch presses. That meant cleaner and safer working conditions, less lubricant consumption, and fewer lubrication applications. As a result, STANODRIP is now used throughout the press room and is being adopted by other departments as well. "Reduced maintenance costs and longer life of our equipment are definite advantages . . . ," says Don Hartquist, Plant Engineering Supervisor.

To help put STANODRIP Dripless Oils to work wherever leakage or drippage is a problem . . . or for assistance in all phases of industrial lubrication . . . call in the Standard Oil lubrication specialist in your area. Contact your local Standard Oil Company (Indiana) office, or write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

Stanodrip
Dripless Oil

What's your problem?

C. B. Eggen of the Standard Oil office in Joliet is the specialist who helped solve this press room lubrication problem for A. O. Smith Corporation.

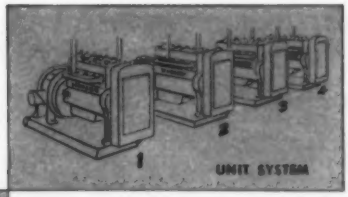
With a broad background of practical experience and special training, his service is typical of the assistance available to plants located everywhere in the Midwest. Like others in the corps of Standard Oil lubrication specialists, he makes his headquarters near the plants he serves.

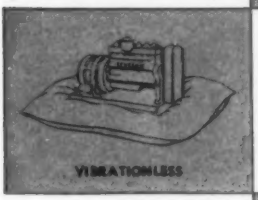
To take advantage of prompt, on-the-spot service in your own plant, phone or write the Standard Oil office in your area. When the lubrication specialist calls on you, be sure to get full information on these fine Standard Oil products:

CALUMET Viscous Lubricants—These greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of open gears and chains, better internal lubrication of wire ropes.

STANORUST Rust Preventives—The eight grades of STANORUSTs form one of the most complete and effective lines of rust preventives available. Each has been scientifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD OIL COMPANY **STANDARD** *(Indiana)*





SCHRAMM COMPACT COMPRESSORS

COMPACT–

SCHRAMM AIR COMPRESSORS

are ideal for

INDUSTRIAL INSTALLATIONS

When shop or factory space is at a premium you will find the Schramm "built-in" motor drive meets all of your requirements. It is not only one of the most *compact* compressor combinations built, occupying only a fraction of the space required by other makes and designs of compressors, but also one of the easiest compressor combinations to install. Both compressor and motor are mounted as a single unit on a substantial steel base, which can serve as a foundation. A neat and compact package that can be installed wherever motor current is available.

Built in sizes ranging from ½ to 100 horsepower.

Write for booklet C-50B for further information.

SCHRAMM INC.

The Compressor People

WEST CHESTER · PENNSYLVANIA

SCHRAMM, INC. • WEST CHESTER, PA.

Please send Free Booklet C-50 B on installing Stationary Air Compressors.

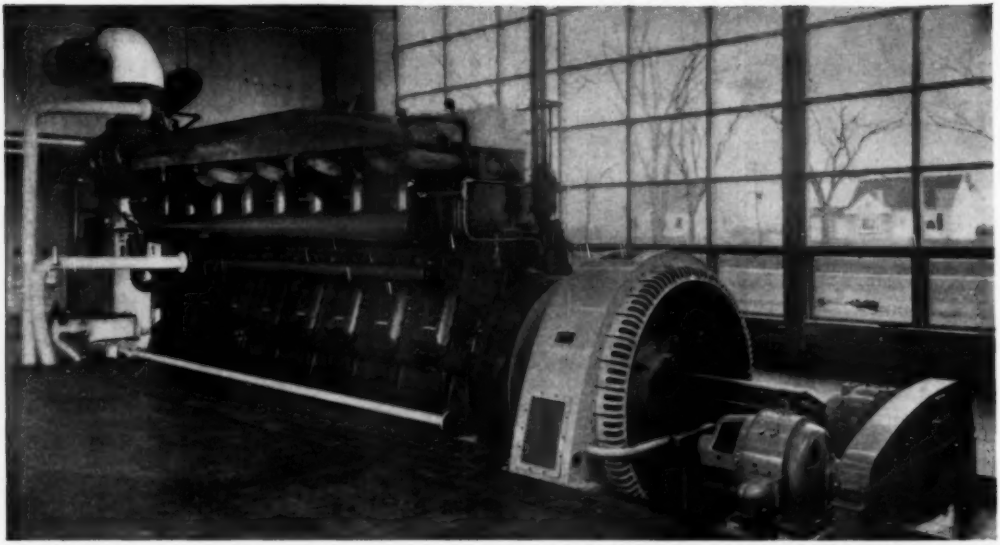
*Name*_____

*Title*_____

*Company*_____

*Street*_____

*City*_____ *Zone*____ *State*_____



Typical Worthington supercharged engine-generator unit.

Makes money when the load is low Makes more as the load grows

You take care of the present and future *both* when you put your electric power generation in the hands of a Worthington 4-cycle super-charged Diesel engine.

Records show that such an engine, even when operating at a low load factor, is economical and maintains its economical performance as the load increases through the years.

For example: a Worthington 1500-hp supercharged engine at 40% load produces more kw-hrs per gallon of fuel than a 1000-hp naturally-aspirated engine at 60% load factor.

So it's cheaper to install a 1500 hp-engine today than to install a 1,000 hp-engine today and a 500 hp-engine later.

When you buy a Worthington 4-cycle supercharged engine, you benefit, too, from the longest experience of any manufacturer with this type of engine. For *any* engine application, call on Worthington—an engine for any fuel: oil (crude or regular), gas or "dual fuel". Worthington's complete line of engines assures you of the most economical operation no matter what fuel you use.

If gas or any combination of gas and oil offer fuel economies, consider Worthington gas or dual fuel engines. Only Worthington offers such exclusives as dual plunger pumps, gas micrometering valves for each cylinder, and thermal air controls—all built to give optimum performance for the fuel used.

For further details of the dependable, economical Diesel performance that proves *there's more worth in Worthington*, contact Worthington Pump and Machinery Corporation, Engine Division, Buffalo 5, New York.

WORTHINGTON

E.1.3

ECONOMICAL CONTINUOUS POWER
Diesel Engines, 150 to 2,640 hp . . .
Gas Engines, 190 to 2,880 hp . . .
Dual Fuel Engines, 345 to 2,640 hp.

WORTHINGTON-BUILT AUXILIARIES

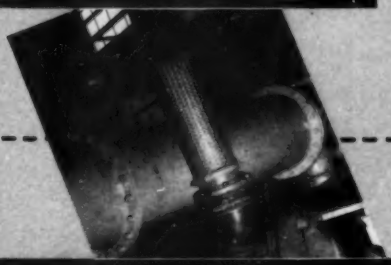
Balanced Angle Compressors

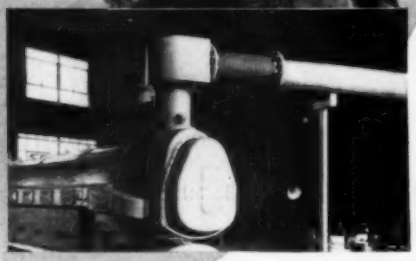
Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative-Type Engine Water Cooler

Large Diameter CMH REX-WELD CORRUGATED FLEXIBLE METAL HOSE



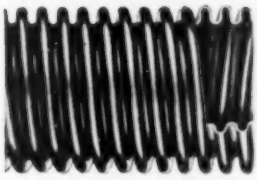


the answer to motion control for:

Diesel Engine Air Intake and Exhaust Lines • Tank Settling Connections • Safety Valve Vent Piping • Compressor Vibration Connections • Heavy Duty Loading and Unloading • And Many Other Services

Wherever large diameter connections must have the flexibility to absorb vibration or expansion and contraction, correct for misalignment or allow movement, and yet provide the rugged durability of metal, CMH REX-WELD Type RW-75 is the answer. REX-WELD Type RW-75 is the flexible connection that requires no packing, no periodical maintenance. All metal construction is completely gas and liquid tight.

For full information and data sheets see your local CMH distributor—look for his name in your classified telephone directory—or write direct.



CMH REX-WELD Type RW-75 is helically corrugated flexible steel hose and is made in sizes from 5" to 24" I.D., inclusive. Furnished with standard pipe nipples, couplings, fixed or floating flanges. Flanges to customers design can also be attached. Where required RW-75 can be supplied with metal braid covering.

Flexon identifies CMH products that have served industry for over 49 years.

CHICAGO METAL HOSE Corporation

1335 S. Third Ave. • Maywood, Ill. • Plants at Maywood, Elgin, Rock Falls, and Savanna, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

CMH

ONE DEPENDABLE SOURCE
for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

FOR OVER 25 YEARS CANTON UNDERFEED STOKERS HAVE BEEN OPERATING EFFICIENTLY IN PRACTICALLY EVERY TYPE COMMERCIAL AND INDUSTRIAL BUILDING

54 TYPES AND SIZES TO CHOOSE FROM

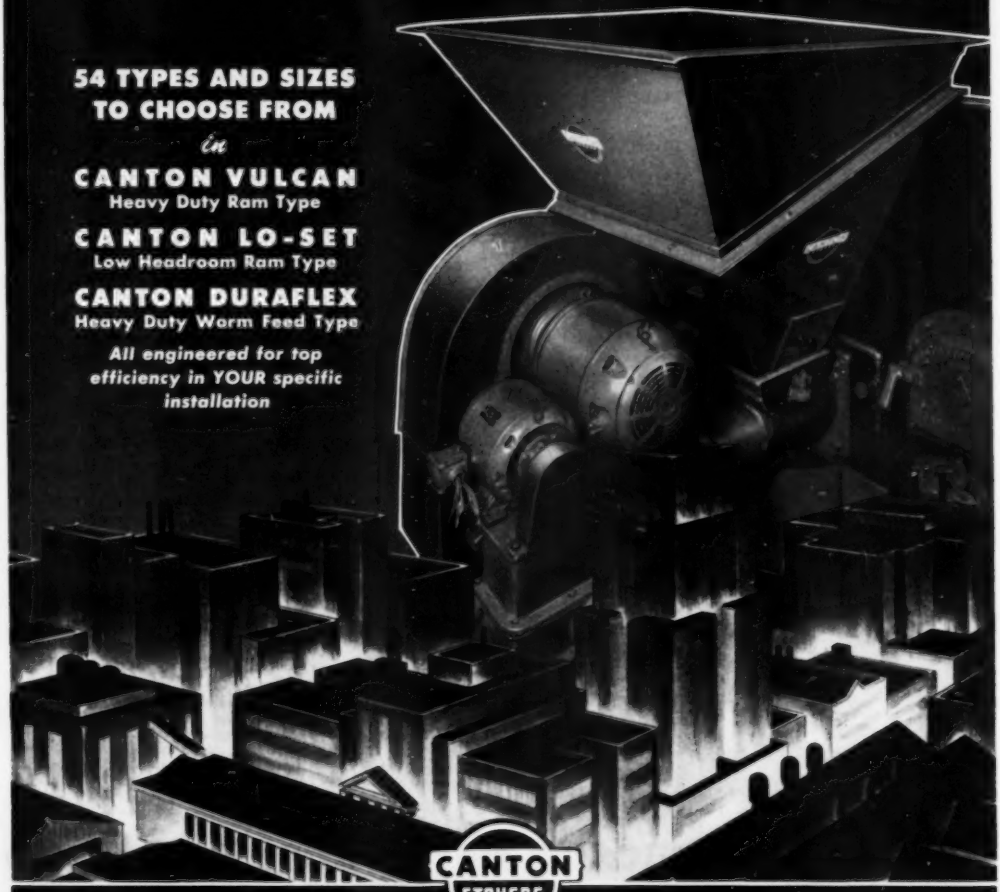
in

CANTON VULCAN
Heavy Duty Ram Type

CANTON LO-SET
Low Headroom Ram Type

CANTON DURAFLEX
Heavy Duty Worm Feed Type

All engineered for top efficiency in YOUR specific installation



CANTON STOKERS

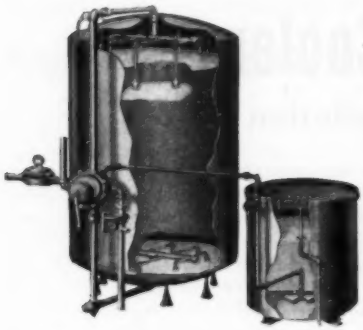
CANTON STOKER

CANTON STOKER CORP. • 403 ANDREW PLACE • CANTON 1, OHIO

See What an ELGIN Water Softener can do for you

Prevents Boiler Scale Formation
Prevents Scale Deposits in Water Lines
ELGIN WATER SOFTENER
Prevents Scale Formation in Cooling Systems
Eliminates Costly Hard Water Troubles
Provides Soft Water for Processing
Keeps Water Heaters Clean

. . . One low cost investment . . . many profitable uses with the softener that gives up to 44% more soft water



NO OTHER water conditioning equipment serves so many useful purposes so *profitably* as the Elgin Zeolite Water Softener. It enables you to take full advantage of *all* the economies of softened water because its *extra* soft water output means *extra* dollar-saving uses.

In a given size softener this extra capacity can represent the difference between doing just *part* of a job and doing *all* of the job—the difference between providing just enough soft water for boilers and providing the extra soft water for preventing scale in water heaters, water lines, cooling systems, process work.

Yes, the records of thousands of installations prove that Elgin is today's most economical softener to buy and to operate. The reward of 43 years of intensive experience, it delivers up to 44% more soft water than other equipment of equal size using the same type of zeolite. A revolutionary "Double-Check" manifold arrangement makes this remarkable performance possible by permitting a deeper zeolite bed to be used more effectively without zeolite loss.

Elgin's "Double-Check" manifold arrangement and new high capacity zeolites can be used in existing water softeners of any make to greatly increase soft water output and give better-than-new performance. Whether you need a new water softener, or whether your present one needs rejuvenation, it will pay you to find out how much Elgin has to offer you.

Ask for Bulletin 610 or let us have our nearest representative call.

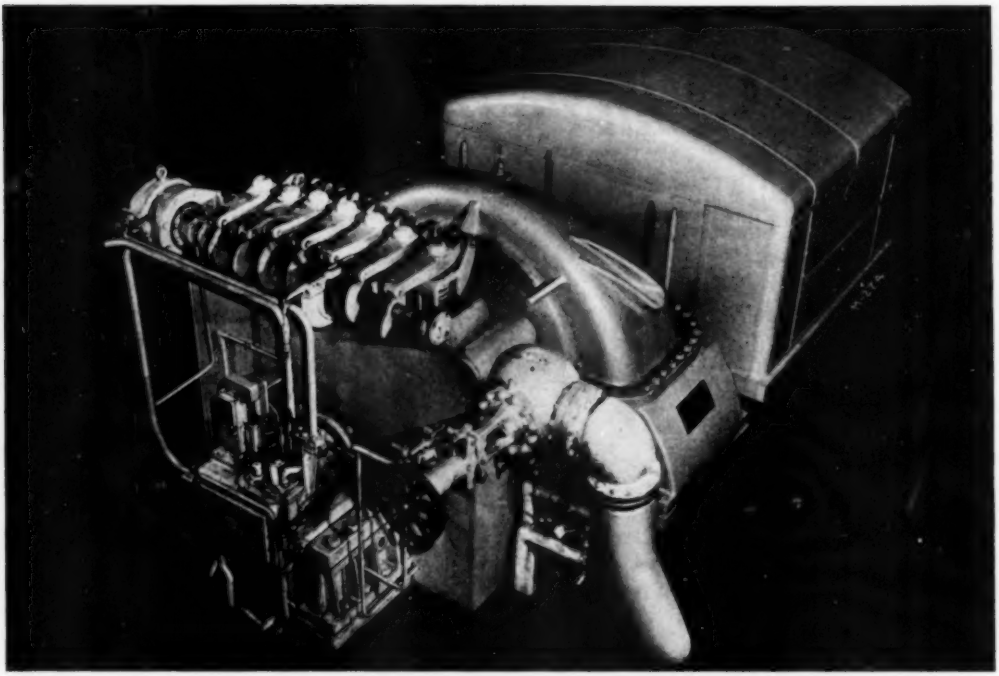
How to make your water softener give up to 10 times more soft water

By simply replacing the low-capacity zeolite in your present water softener with new high-capacity Elgin Zeolite, you can increase its soft water output as much as 10 times. And if still more capacity is needed, you can get it by means of the Elgin "Double-Check" manifold arrangement which permits for more zeolite to be placed in your water softener. Let us give you complete details.

ELGIN SOFTENER CORPORATION
138 North Grove Ave., Elgin, Ill.
Representatives in Principal Cities

ELGIN
Economical
WATER CONDITIONING
FOR EVERY NEED

OTHER PRODUCTS: Deionizers • DeAlkalizers • Filters • Degasitors • Corrosion Control Systems • Water Treating Chemicals • Water Testing Equipment



Side-Mounted Coolers

simplify turbine installation

This 5000 kw Worthington turbine generator was installed several years ago by a midwest cement producer.

The generator is equipped with split, side-mounted air coolers. This arrangement is desirable where it is necessary to save basement space below the unit. These coolers are readily accessible, and each can be cleaned while the unit is in operation.

Selection of a Worthington turbine generator gives *unit responsibility* for design, assembly and performance. All Worthington turbines and generators are tested *together* as a unit before shipment.

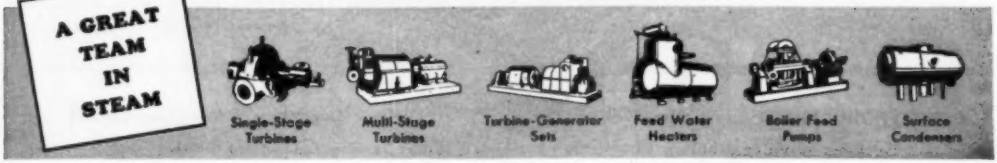
Worthington builds turbine-generator sets in sizes up to 10,000 kw. For detailed proof that *there's more worth in Worthington* . . . call our nearest office or write to Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.

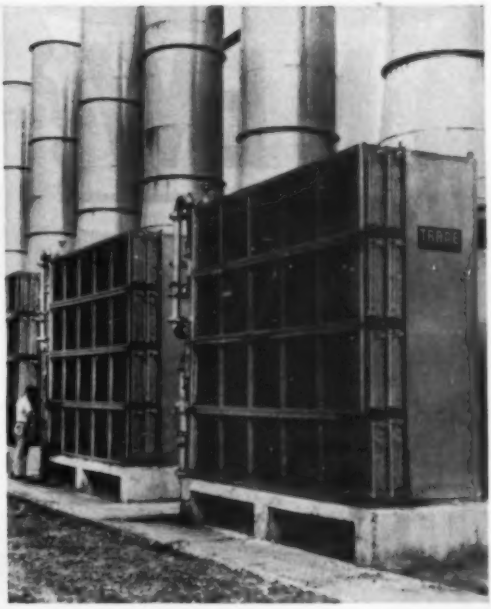
WORTHINGTON

STEAM TURBINE GENERATORS

T.I.5

A GREAT TEAM IN STEAM





Laboratory . . . Reduction Plant . . . Assembly . . . Dock . . . Service Station

Trane Air Conditioning Serves Everywhere in Industry

Industries of every kind and size are finding the answers to their heating and air conditioning problems in the broad Trane line.

Constant Temperature Fog Room—A cement manufacturer wanted to test concrete specimens under extreme humidity conditions, at constant temperatures. Trane Climate Changers kept the test room at 73° constantly the year around.

To Cool Gas Engines—The location of a new aluminum reduction plant in the south had plenty of natural gas and good transportation. But there was no water to cool the 120 1800-hp engines used for power. This situation was remedied when 120 Trane Fluid Coolers were installed to keep jacket water at just the proper temperature.

Window Blanketing—The windows in the new plant of a scale manufacturer admitted plenty of light to a delicate assembly line. But the great glass area created greater possibilities for drafts. That is until Trane Wall-Fin Heaters were installed to blanket the windows with heat without obscuring the light.

Washing the Walls with Heat—Long loading docks, like the one in a Michigan chemical plant, call for a lot of heat to combat the cold air from constantly opened doors. A battery of Trane Horizontal Unit Heaters wash the exposed walls and blanket the doorways with all the heat that's needed.

Tempering Freezing Air—The diesels of a famous railroad discharge a lot of gas-laden air as they enter a terminal service station. As the bad air is exhausted, clean outside air is brought in and heated with Trane Nonfreeze Heating Coils.

Whether it's laboratories, reduction plants, assembly, docks or service stations, Trane air conditioning serves industry everywhere.

Whatever your factory heating, ventilating, cooling or air conditioning problem, look for the answer in the complete Trane line.

In Assembly Departments—Trane Wall-Fin Heaters are tucked up under the girders.

In Loading Areas—Trane Horizontal Propeller Unit Heaters kill drafts before they start.

In Service Stations—Cold outside air is heated with Trane Coils before it is used for ventilation.

TRANE

MANUFACTURING ENGINEERS
OF HEATING, VENTILATING AND
AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pennsylvania
Trane Company of Canada, Ltd. . . . Toronto
OFFICES IN 80 U. S. and 14 CANADIAN CITIES

NEW

SERIES 12100*

FORGED STEEL

DROP

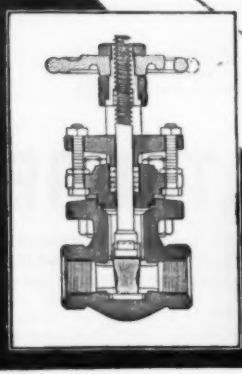
Vogt

BOLTED BONNET
BOLTED GLAND

150-800 POUND

GATE VALVES

SIZES ¼" to 2"



*Series 12100

CARBON STEEL } 800 Pounds @ 750° F.
1500 Pounds Cold Non-Shock

For 150-800 pounds service • Round Bolted Bonnet • Bolted Gland • Gasket or Ground Joint • Outside Screw and Yoke • Renewable Seat Rings • Solid Wedge — Slotted Type • Rising Stem 11½-13% Chrome Stainless Steel Trimmings • Sizes ¼" to 2" inclusive.

HENRY VOGT MACHINE CO. *Louisville 10, Ky.*

BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • ST. LOUIS • DALLAS

The Quick, Economical solution to **Heating Gases** and **Process Air**

CHROMALOX Electric Heaters

CHROMALOX offers you a wide variety of electric heaters to fit the temperature requirements of your jobs and the physical dimensions of your equipment. CHROMALOX Units are the dependable, efficient answer to heating recirculating ovens. They quickly and simply convert air-conditioning systems to central heating systems. Units are available for heat treating ovens, annealing ovens, core and armature drying ovens and similar applications. Operating temperatures up to 1000° F. are easily achieved and accurately maintained by thermostat control. Standard units are quickly installed in existing ducts and multiple circuits can be supplied for modulating the heat output.

CHROMALOX

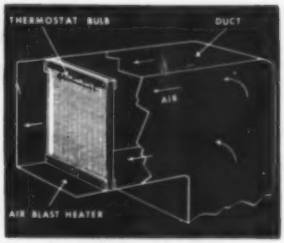
Electric Heat for Modern Industry

IC-87

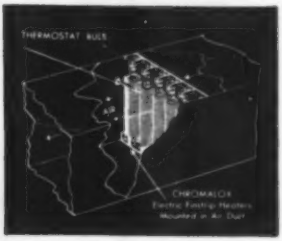
CHROMALOX

dependable, efficient

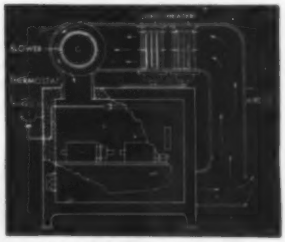
HEAT



Ⓐ **AIR BLAST HEATER** slides into duct for heating air under forced circulation. Two or more heaters may be mounted in same duct. Built-in bus-bar easily connected for single or multiple-circuit control.



Ⓑ **FINSTRIP HEATER** for drying, curing, space heating and other applications requiring heat under forced circulation. Heat is quickly dissipated by parallel-fin construction with minimum air-friction loss. Flanges simplify mounting.



Ⓒ **DUCT HEATER** mounted in recirculation oven for temperatures from 400° to 1000° F. Multi-circuit units allow varying heat outputs. Moisture-proof construction is ideally suited to many jobs.

Want more Know-How?

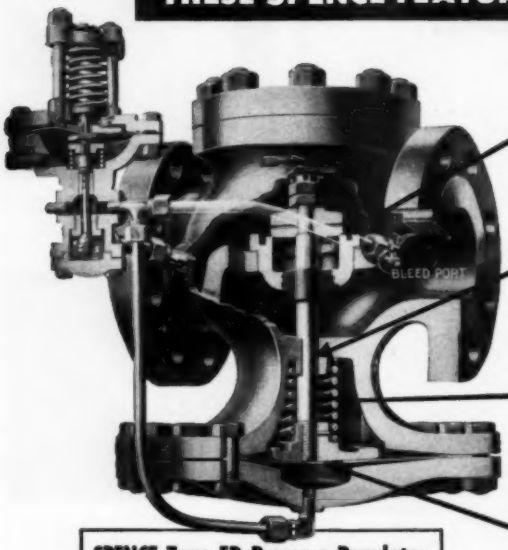
Send for Catalog 30 and the useful booklet of application ideas "100 Ways to Apply Electric Heat". They are both yours without obligation.

Industrial Heating Division
EDWIN L. WIEGAND COMPANY
7520 Thomas Boulevard
Pittsburgh 8, Pa.

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

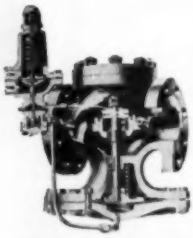
SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

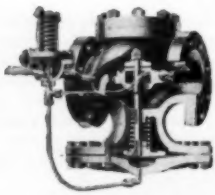
YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.

Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

Job Expediters

W-111 Welding Blowpipe

CW-111
Cutting
Attachment

If you work with metals, there's a spot in your shop for this time- and money-saving PREST-O-WELD combination. For the W-111 Blowpipe easily handles any welding job—from light sheet to thickest casting—and makes fast work of all ordinary heating and forming operations. The CW-111 adapts it for cutting and shaping steel up to 4 inches thick, or for groove-cutting.

Since Cutting Attachment and 17 different lengths of welding heads fit the same blowpipe handle, a switch from welding to cutting or back again is as simple and quick as changing a welding head. No time is lost. You're always ready for any job that comes up.

Your nearby PREST-O-WELD Jobber will be glad to show you how this apparatus helps to reduce equipment inventories, boost production, and cut costs. See him today.

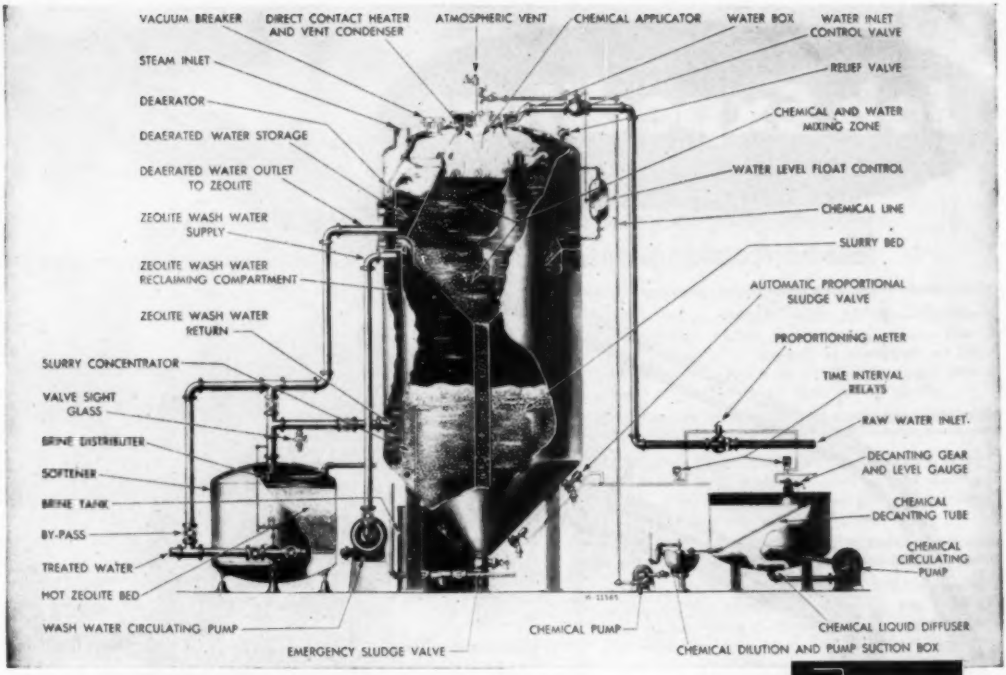
PREST-O-WELD
Trade-Mark

W-111 WELDING BLOWPIPE with
5 Heads and Wrench...$38.00
CW-111 CUTTING ATTACHMENT
with 2 Nozzles.....$29.50

The term "Prest-O-Weld" is a registered trademark of Union Carbide and Carbon Corporation.

Order from your local Jobber

Or write for more details. Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y.



Here's how to make water softening a soft job for you

You have less to do . . . to worry about . . . to pay for—when you use Worthington's revolutionary Hot-Z Slurry-Type Deaerating Water Softener.

It combines all the best features of Hot Process and Zeolite, plus these Worthington-originated features:

No more scaling trouble. Direct-contact vent condenser eliminates scaling trouble experienced with old-fashioned shell-and-tube types.

Supervision reduced. Concentrated sludge is removed automatically and proportionately to water volume.

Assures uniformity. Hydraulic chemical mixer assures uniformity of chemical strength. Also saves space.

Easier cleaning of valve-type wash water sight glass.

Better deaeration. Steam-jet deaeration is simpler, gives better efficiency—removes oxygen to .005 cc per litre.

Independent backwash system. Built-in annular wash water compartment provides clear hot water for backwashing and reclaims it without affecting operating velocities in treating zone. This feature not only pays off in systems employing filters, but also is ideal for backwashing the hot zeolite.

You also save because Worthington Hot-Z Systems operate on low-priced lime and salt. The average installation saves enough in chemical costs to pay for itself in 3 years!

Get all the facts!

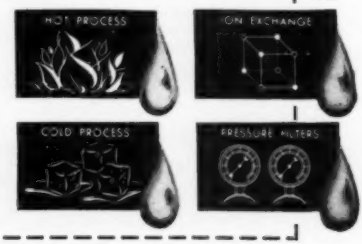
It will pay you to investigate the Worthington Hot-Z System thoroughly. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find *there's more worth in Worthington.* Worthington Pump and Machinery Corporation, Water Treating Section, Dunnellen, N. J.

A1.2

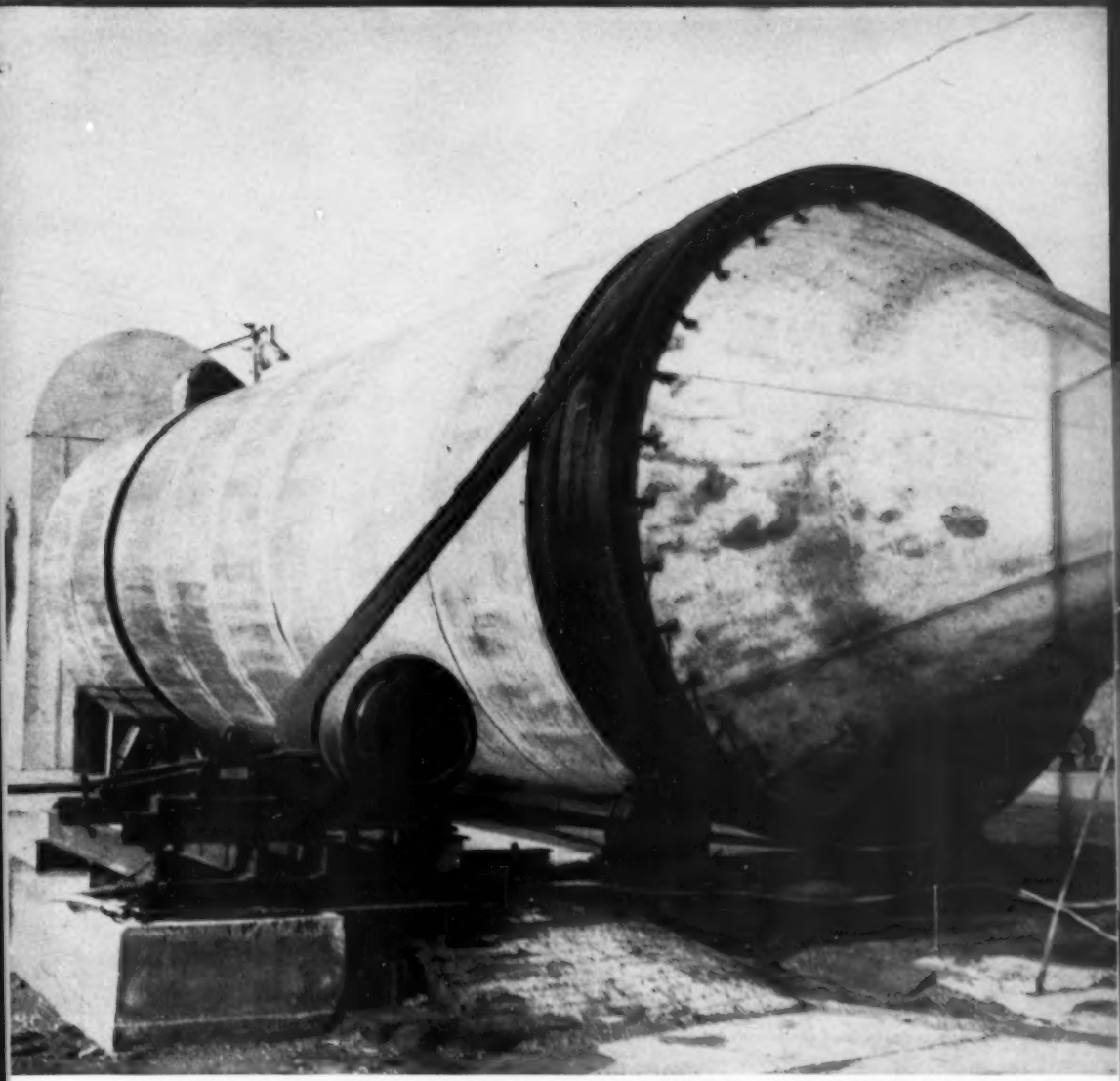
WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



B.F.Goodrich **GROMMET BELTS AT WORK**



Steel cylinder half a block long spins like whirling top at Albers Dehydrating Company, Wisner, Nebraska.

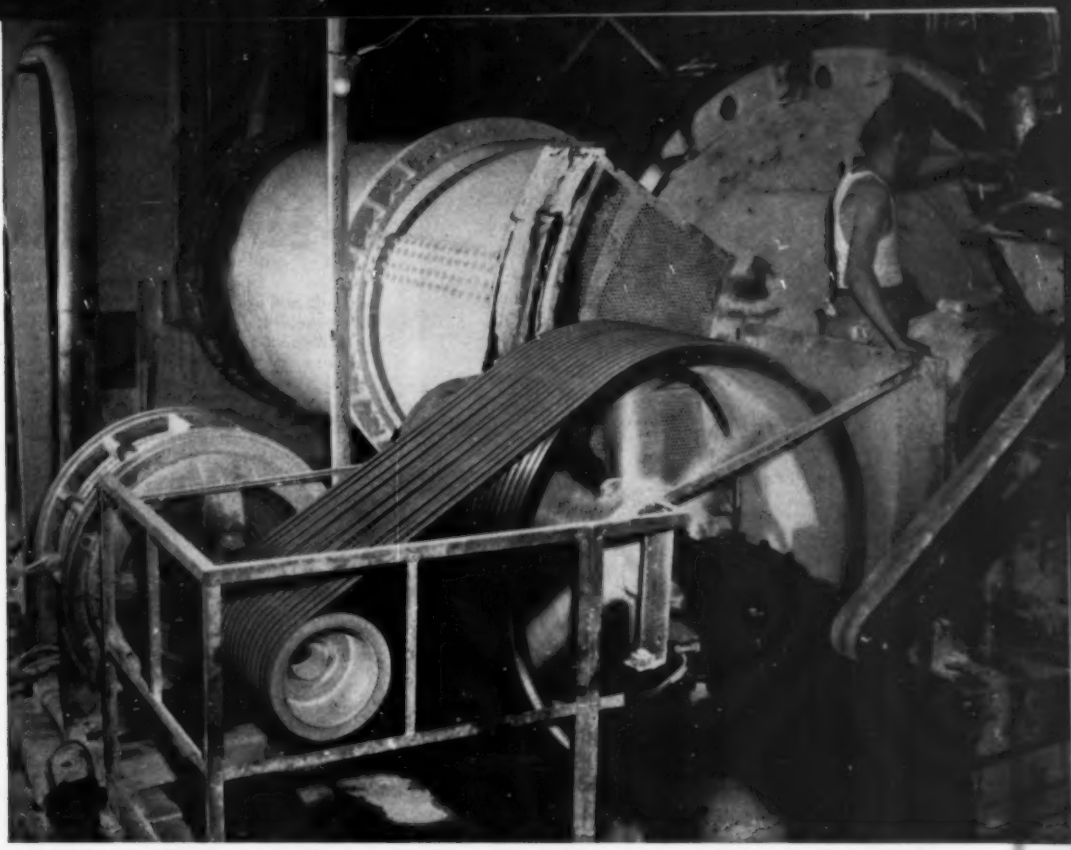
Whirling steel kept town awake

This big cylinder weighs three tons. From June to September it spins like a top to dehydrate cattle feed. But the big gears that powered the machine were so noisy the whole nearby town of Wisner, Nebraska was kept awake—and objected. Strenuously. Engineers knew that rubber belts, used instead of gears, would be quiet, but ordinary rubber belts would have gone to pieces in a few months. An entirely new kind of belt was needed. To find out how the problem was solved, see the following pages.

Whirling steel (continued)

City council heard loud complaints before these belts were put to work turning cylinder shown on preceding page.

NOT only did the company that operates this dehydrating cylinder want to make the whirling steel noiseless, they wanted to reduce operating costs, too. So they couldn't afford merely to install ordinary V belts. The local B. F. Goodrich distributor recommended B. F. Goodrich grommet V belts. They were installed and have been running for two seasons now, 7 days a week, and are still going strong. Now the town sleeps and the feed company saves 50% in operating costs.



It's so hot in this ball mill grinding hot sand that the fire sprinkler system, set at 190°, occasionally pops off.

Belts boil in hot sand mill

The V belts driving this ball mill help grind hot sand, heated to 260°, to a fluffy powder used for fine glass, pottery, cosmetics. Ordinary V belts were lasting one to two years. B. F. Goodrich grommet belts replaced them, have lasted over five years. Grommet belts stay cooler because they generate less internal heat and are made of a rubber that stands boiling temperatures.

Inside ordinary V belts made with multiple cords, there's a slight bump or "shoulder" where these cords overlap. This is the weak spot—over 80 per cent of belt breaks happen at this point. B. F. Goodrich grommet belts have no overlapping cords.

20 to 50% Longer Life

Patented grommet belts by B. F. Goodrich represent the only basic change since invention of the V belt. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

What is a Grommet?

A grommet is like a giant cable except that it's *endless*—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put to Work

Each grommet and every part of a grommet carries its share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume.

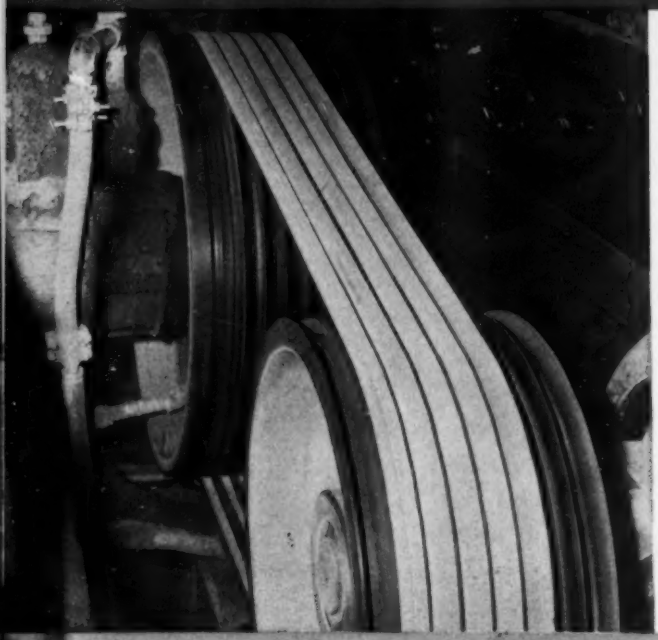
Better Grip, Less Slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They Cost No More

You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent Number 2,233,294).

B.F.Goodrich GROMMET BELTS AT WORK



8-to-5 shift

Belts will never give full service when a drive is underbelted. But plant accidents happen. This is actually an 8-belt drive for a limestone crusher running seven days a week. The accident damaged three of the belts and no spares were on hand. The plant engineers had to let the remaining five belts run. They have done the job perfectly. The extra strength of the B. F. Goodrich grommet belts, at left, saved the plant a shutdown.

Other users' experiences show this extra strength too:

". . . within a few days ordinary belts had stretched . . . After six months of 24-hour-a-day service, BFG grommet belts haven't stretched at all . . ."

"Our belt service was tripled when we changed to grommet belts . . ."

"Ordinary belts lasted 5 or 6 weeks . . . BFG grommet belts are in their sixth month of service."

← *Belts prevented shutdown at Calveras Cement Co.*

The three preceding pages tell you why B. F. Goodrich grommet belts differ from ordinary V belts with actual examples to prove that they outlast ordinary belts—sometimes 10 to 1, at no extra cost.

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio

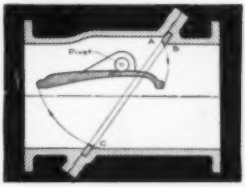
YOU GET

Cushioned Closing

WITH

CHAPMAN

TILTING DISC CHECK VALVES



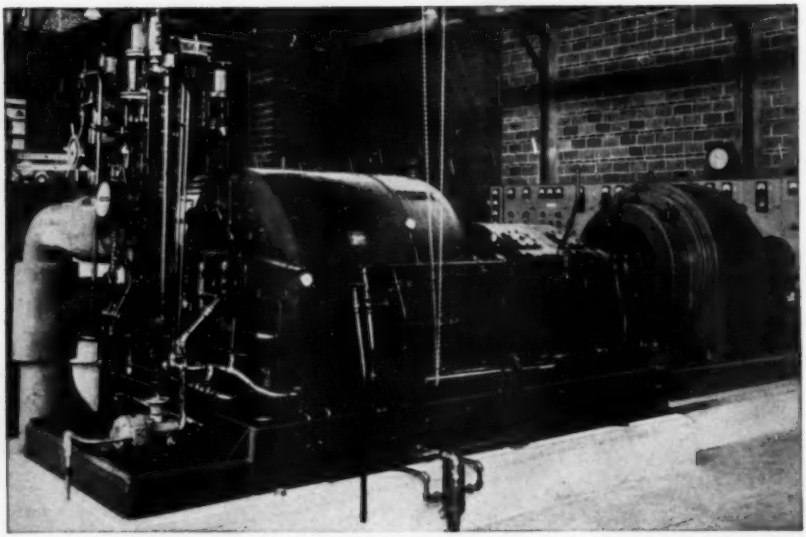
Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

There's no impact on closing — with this valve by Chapman. The balanced disc rides the flow smoothly — uses the fluid or gas itself to cushion the closing action. The disc lifts away from the seat easily on opening; closes quickly, positively—yet quietly.

Consequently, there's no rubbing on the seats—little wear on hinge pins and bearings. Repair needs are at a minimum — maintenance costs low.

Chapman Tilting Disc Check Valves are available in either iron or steel. Write today for catalog with complete technical information.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS



Proved Turbine Economy

AT NARRAGANSETT BREWERY

For the past twenty years this Rhode Island brewery has been growing — and incidentally proving out turbines in its plant.

The first Terry Turbine was bought in 1936 and enabled the brewery to take full advantage of power generation as a by-product of its process steam.

One of the latest Terry Turbines installed in this plant is shown above. It is a 1000 kw mixed-pressure bleeder condensing turbo-generating unit. Initial steam is 265 pounds with 70 degrees superheat. Process and heating steam is bled at 22 pounds. Any steam not needed for process, passes through the low-pressure stages to the condenser. So if there is an excess of low-pressure steam from the high-pressure section of the turbine or from other sources, it is automatically admitted to the turbine and converted into power.

With other Terry units it provides great flexibility in power available, full stand-by capacity, low cost power and excellent automatic heat balance with ample clean steam, at low pressure, for such functions as kettle boiling, washing, bottling and heating.

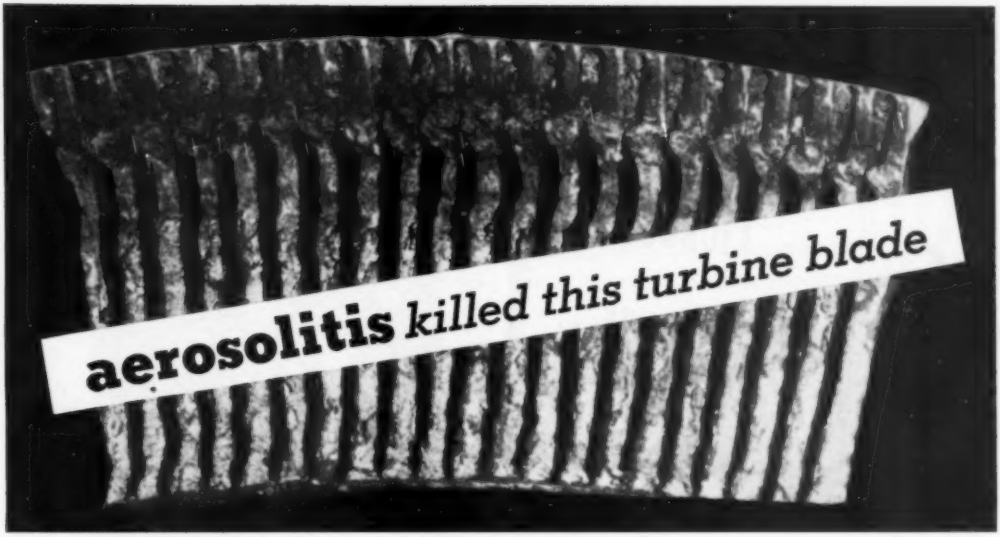
Evidently these Terry Turbines have performed economically — altogether six were bought in 1936, 1940 and 1946.

A Terry installation may be as profitable for you as in this plant. We will be glad to discuss the possibilities with you.

TERRY

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT 1187



Dearborn polyamide anti-foams prevent this

deadly boiler disease

Here is an unretouched photo of a turbine blade that was *killed by aerosolitis.* Replacement was, of course, both necessary and expensive.

But *aerosolitis*—more prevalent with some waters than with others—can be easily and inexpensively prevented with Dearborn Improved Polyamide Anti-Foams. In addition to inhibiting the formation of harmful *aerosols,* Dearborn Polyamide Anti-Foams prevent foaming to produce purer steam—eliminate scale formations—condition sludge—are compatible with other treatment.

IF YOU USE STEAM for power or process, investigate the time-, money-, and labor-saving advantages of Dearborn Polyamide Anti-Foams and the complete Dearborn Industrial Water Treatment and Engineering Service. A Dearborn engineer is at your service. The coupon is for your convenience.

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza • Chicago 54, Illinois

AEROSOLITIS AT WORK

Aerosols are tiny drops of water dispersed in the steam which cause encrustation on superheaters, foul turbine blades. When this happens, boilers have aerosolitis, and costly shutdowns and repairs will result.

Dearborn Chemical Company, Dept. INP
Merchandise Mart Plaza
Chicago 54, Ill.

Gentlemen: Please send:

- ☐ Bulletin on Dearborn Improved Polyamide Anti-Foams
- ☐ Bulletin on Dearborn Industrial Water Treatment and Engineering Service
- ☐ Have a Dearborn Engineer call

Name.....

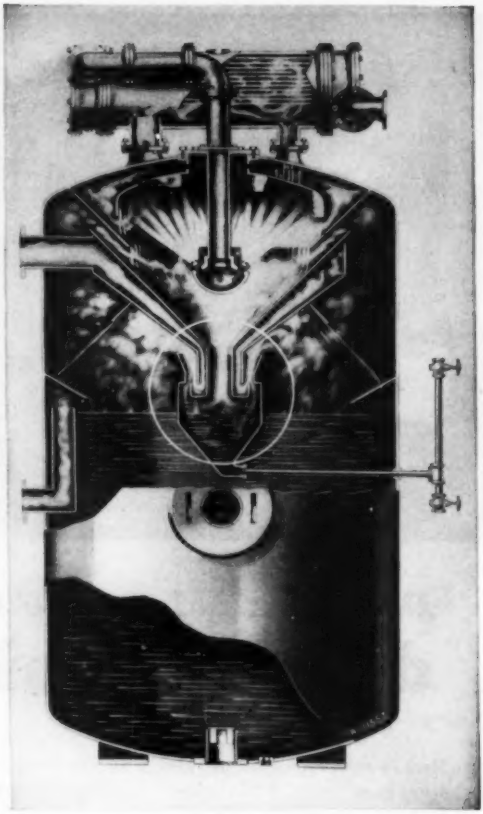
Company.....

Position.....

Address.....

City.....*State*.....

Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES



Hard scale, formed on the trays of deaerating evaporator preheaters, is no longer the big problem it used to be.

In a large central station (name on request), the preheaters had to be cleaned every three weeks, and the units were completely shut down at that time from eight to ten hours.

Then Worthington steam-jet deaerators were installed—with a "blowdown" head designed by Worthington engineers. This special head allows the operator to remove harmful deposits at regular intervals *while the unit continues in service.* It also provides for simple and speedy acid cleaning of critical parts, when necessary, without even opening an access door or removing any parts from the unit.

Compare The "Time-Outs"

The Worthington unit, given a short blowdown once each shift, stays in continuous operation with maximum deaeration for periods of at least 8 months. When the acid treatment is given at the end of that period, the job is finished in under three hours.

Compare this with the former record. *Then*—8 to 10 hours outage every three weeks and labor by a *crew* of men. Now—with Worthington's blowdown head—operation uninterrupted during regular short blowdown, with a shutdown for acid cleaning only once in almost a year, requiring only one man and three hours!

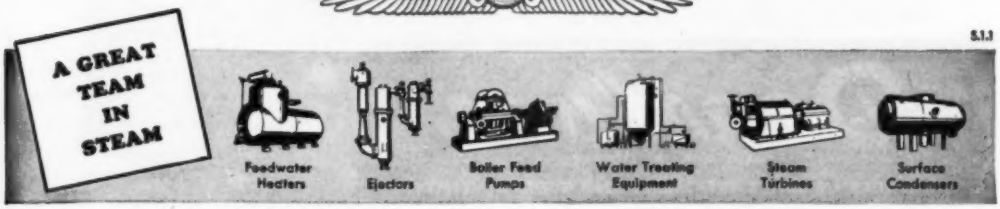
Worthington Makes Deaerating Equipment News

Developments like this, applicable to any deaerators operating under conditions of scaling, are typical of Worthington's engineering firsts in water treating and deaerating equipment.

Worthington manufactures all of the equipment needed in a complete water treating installation. For further information on why *there's more worth in Worthington*, address Worthington Pump and Machinery Corporation, Steam Power Div., Harrison, N.J.

WORTHINGTON

S.1.3



—ONE JOHN ZINK JZ STOP—
BURNER SERVICE

Between - the - Tube
BURNER

The application of the John Zink patented ST Gas Burner to industrial or power boiler installations is a radical improvement in boiler firing.

It is not necessary to form the tubes around the burner to secure maximum heating efficiency. Flame contact is equalized along all heating surfaces.

BE SURE TO ASK ABOUT OUR NEW SMOKELESS FIELD FLARE

•

— DEALERS —

J. ARTHUR MOORE
342 Madison Ave., New York

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COMBINATION GAS & OIL BURNERS
FOR EITHER VERTICAL or HORIZONTAL FIRING

SERIES CBM

Full rating may be taken with completely satisfactory fires with either fuel.

Both fuels may be fired in combination if necessary.

A new file and register design permits operation at low excess air.

Any gaseous fuel at pressure in excess of 5 lbs, may be burned.

Any commercial grade of fuel oil may be burned when properly prepared.

CBM

SERIES Y & SERIES YC

John Zink Series Y and YC Combination Gas and Oil Burners are particularly designed for boilers and process furnaces where maximum heat release at low excess air and high heat density place a premium on reliable burner performance at low first cost.

MAXIMUM DUTY—MINIMUM DRAFT.

RUGGED WEATHER-PROOF CONSTRUCTION.

SIMPLE IN DESIGN.

LIGHT-WEIGHT FUEL GUNS ARE EASY TO REMOVE.

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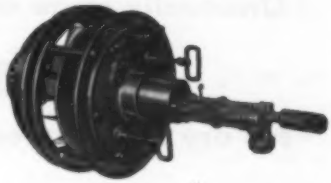

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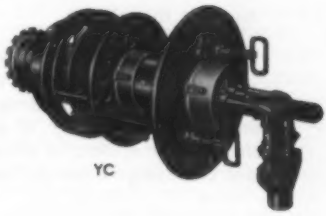

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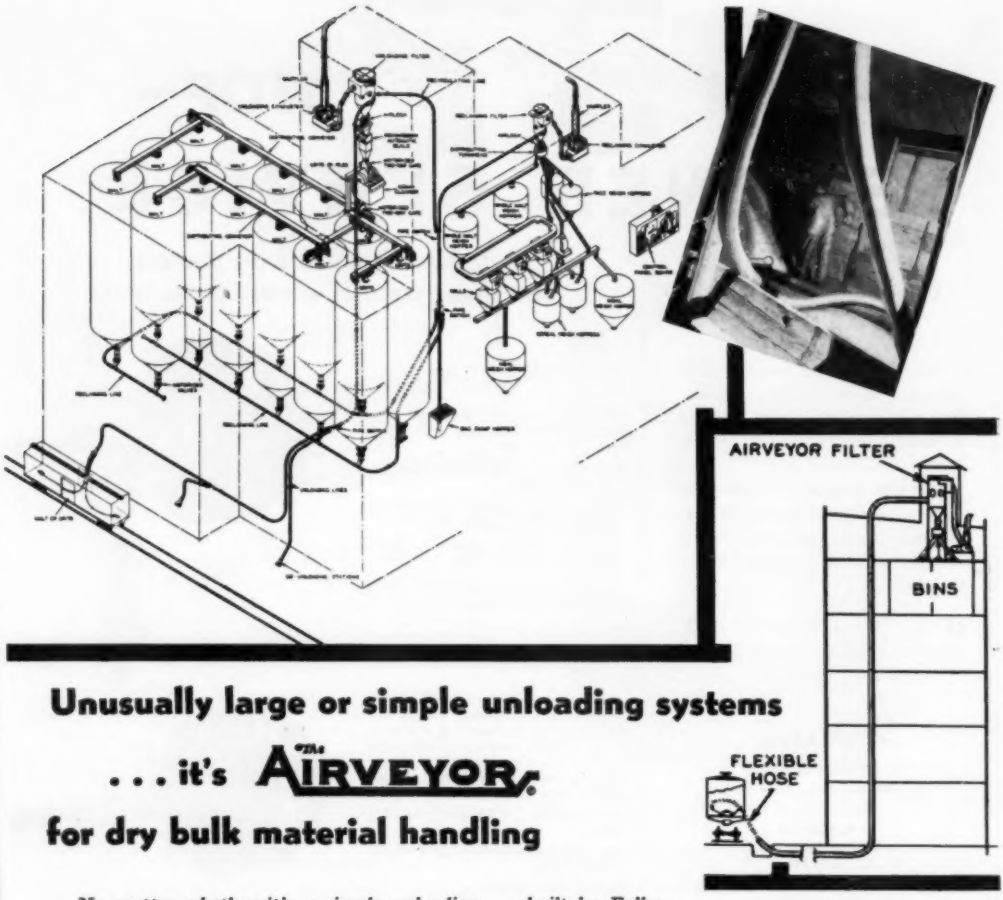

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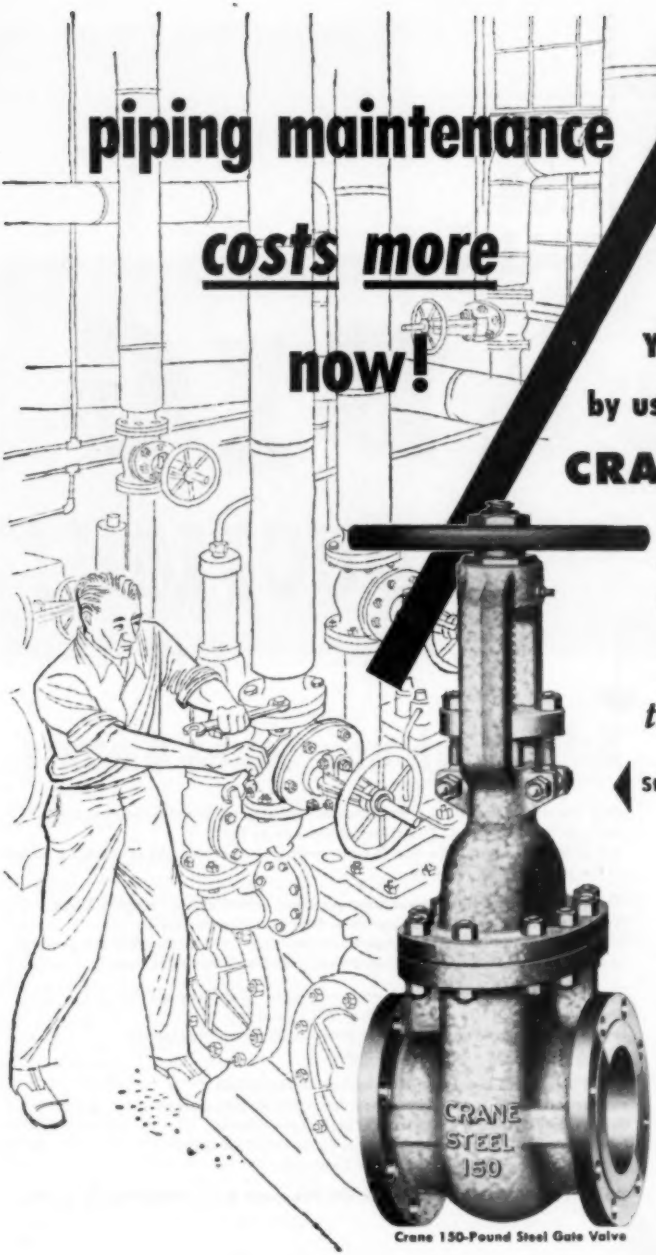

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INDUSTRIAL POWER

August, 1951 Vol. 61, No. 2

BURNING SULPHITE LIQUOR FOR STEAM

After considerable planning and research, the Northern Paper Mills has installed a pulverized coal furnace that will also burn spent sulphite liquor, a byproduct waste usually discharged into the sewer. System licks flyash and scale

Density of smoke from stack passes rigid city ordinance. Collectors were designed from flyash samples

H. W. GOCHNAUER, *Chief Engineer*
Northern Paper Mills

NORTHERN PAPER MILLS, at Green Bay, Wisc., has recently purchased a 135,000 lb per hr 1250 psi steam generating unit designed for a total steam temperature of 950 F while using pulverized coal as fuel. The need of this additional boiler is due to the program now started for the evaporation and burning of spent sulphite liquor—a stream pollution abatement project. Northern presently has three pulverized coal fired boilers, two of 75,000 lb per hr each and one of 100,000 lb per hr capacity. These boilers operate at 650 psi and 700 F TT (total temperature).

This new boiler, although designed for a higher pressure and temperature, will be operated initially with the same steam characteristics as the existing boilers. It will, however, be designed so that additional superheater tubes can be readily added, and an air heater can be built up at a later date when required.

At the present time a 2000 kw noncondensing turbine and a 3000 kw extraction and condensing turbine furnish power and reduced steam pressure for mill use at 160 and 30 psi. A third condensing turbine of 4000 kw capacity is used to fill in the power requirements.

Due to rather rapid and radical changes in the mill requirements, it was thought advisable to consider additional generating capacity. For this reason a complete new heat balance has been made based on future requirements. The facts so obtained indicated that a higher pressure extracting turbine would be desirable in the future. Thus, the new boiler was purchased to eventually operate at 1250 psi and 950 F TT.

Makeup water amounts to about 50 per cent of the boiler requirements, is obtained from a deep well and is very hard. ZeoCarb softeners are used for all water treatment. A direct contact feed water heater has been purchased that will have a capacity of 400,000 lb per hr with a designed pressure of 52 psi. It will be located above and between No. 3 and the new No. 4 boiler.

TABLE 1—SULPHITE VISCOSITY CHARACTERISTICS

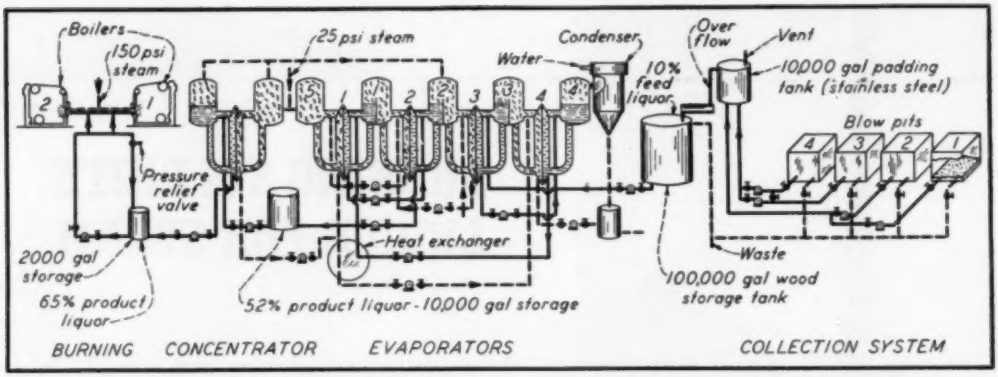
Temperature	Per cent	cp
100 F	60	185
	65	2400
150 F	60	82
	65	230
200 F	60	27
	65	55

Foundations for the building that will house the boiler are completed. The boiler and some of the auxiliary equipment are on order, but much of the equipment is yet to be purchased.

As stated previously, the use for this new boiler unit is due to the plan of burning concentrated spent sulphite liquor, which in itself is a major problem. A report with plans and specifications has been submitted to the State Board of Health and the Water Pollution Committee and their approval has been recently received.

Sulphite liquor will be concentrated through four effect evaporators. When the concentration has been increased from 10 to 65 per cent solids, it will be pumped to the boiler plant for disposal by burning. All of the concentration equipment involved must be of 316 stainless steel including piping valves, tanks, pumps and evaporators. As a result the installation will be expensive.

The evaporators are not of the conventional shell and tube type, but are of plate construction and all of these cells are the same size. Spent sulphite liquor scales very badly but fortunately the scale washes off easily with a



Evaporator and concentrator equipment are designed so that the entire flow can be reversed, changing steam and condensate to the liquor side in order to keep the units free and clean of scale, the most troublesome problem in the process

slightly acid water. This equipment will be so designed that the entire flow can be reversed periodically, changing the steam and condensate to the liquor side and vice-versa. This will keep the equipment clean of scale.

Many burning tests have been made during last summer using concentrated spent liquor. This material was obtained from a pilot plant operated by the Sulphite League at Appleton, Wisc. and under its auspices. It was hauled hot in tank trucks and transferred to two 15,000 gal tanks located adjacent to the boiler plant.

Tanks were heated with steam to maintain viscosity at which the liquor could be pumped. At room temperature a mason jar of 65 per cent spent sulphite liquor can be turned upside down without pouring. This indicates clearly that the material is quite viscous at low temperatures and must be kept hot for pumping and delivering through pipe lines.

A cyclone type furnace was constructed out of an old tank, which was lined with fire brick. A blower provided air through ports or tuyeres in the side to provide centrifugal action. This furnace was first heated with an atomized oil burner, after which 60 per cent spent liquor atomized with steam was injected into the end of the drum.

Spent sulphite liquor, even though it contained 40 per cent water, supported combustion, and the flame coming out of the end of the drum was like a large blow torch. In like manner 60 per cent liquor was burned over a period of time at a rate of 15 gpm.

Equipment was also set up for burning the spent liquor in the existing furnace of the present 75,000 lb per hr boiler. This unit has complete water walls, and powdered coal is injected through two burners. In the center of the burner is the conventional oil burner used for lighting the coal. The oil is atomized with 150 psi steam, and each oil burner is of sufficient size to generate 10,000 lb of steam per hr in the boiler.

Test equipment comprised the two 15,000 gal spent sulphite liquor storage tanks, which were equipped with steam coils to maintain the temperature of the liquor at about 120 F. The liquor is pumped from storage to two wooden measuring tanks of about 725 gal capacity. These tanks were also equipped with heating coils to maintain the temperature of the liquor. The tanks were alternately used and filled for continuous operation. They were calibrated for quantity measurements.

A gear pump was employed to discharge the liquor from the measuring tanks through a heat exchanger to the boiler burners. This heater raised the temperature of the liquor to 210 F at which point it flowed quite readily.

The conventional oil lighting burner was removed from one of the powdered coal burners, and in its place was inserted a standard steam atomizing gun, which had at its tip 18 3/16 in. holes set at an angle of 80 deg. This gun was ordinarily used for burning Bunker "C" fuel oil.

About 12 years ago fourteen sulphite mills in the Green Bay vicinity leagued together to study the problem of spent liquor control. Since the inception of the sulphite process, this waste has been discharged into streams where it was diluted and seemed to have no deleterious effect.

Recently, however, it has been found that a biochemical action takes place because of the wood sugar waste, which causes the oxygen content of the water to be absorbed and thus lowered. If the oxygen content of water is lowered too far it may not support fish life.

Just a word should be said concerning the cooking process involved. Wood chips about 3/4 in. long are cooked from 6 to 10 hr. The acid penetrates into the chips, dissolves the lignin or the binder, and liberates the fiber, which is the cellulose portion of the wood.

This cellulose containing spent sulphite liquor is blown into a perforated bottom blow-pit. The spent sulphite liquor is obtained and washed from the cellulose resulting in a clean cellulose for paper making. The spent sulphite liquor was discharged as a waste. Recent plans call for collecting the strong spent liquor from the blow-pits and pumping it to storage tanks rather than discharging it to the stream.

TABLE 2—ANALYSIS OF SOLIDS

	Per cent		Per cent		Per cent
Lignin	48.0	Combustible solids	92.9	Carbon	41.50
Sulphur dioxide	15.7	Ash	7.1	Hydrogen	4.75
Calcium oxide	7.1		100.0	Oxygen & nitrogen	38.85
Carbohydrates	25.7			Nitrogen	0.13
Proteins	1.2			Total sulphur	6.00
Rosins & fats	2.3	Btu dry	7990	Combustible sulphur	4.46
	100.0			Ash	10.44

This gun inserted through the ignition tube of the burner caused the atomized liquor to be burned simultaneously with pulverized coal. It was thought that the wet liquor injected in this manner might result in a wetting of the powdered coal adjacent to it and cause unburned carbon to drop to the furnace floor. This, however, was not the case. The heat present in the furnace, even though it was water walled, was sufficient to vaporize the 40 per cent water in the liquor without apparent deleterious effects to the combustion of either the coal or liquor. The flame was quite close and very bright. Liquor pressure was 110 psi and steam 115 psi during this test. These tests indicated that 23,200 lb of steam was generated by 745 gal of liquor concentration, 60 per cent solids at 126 F.

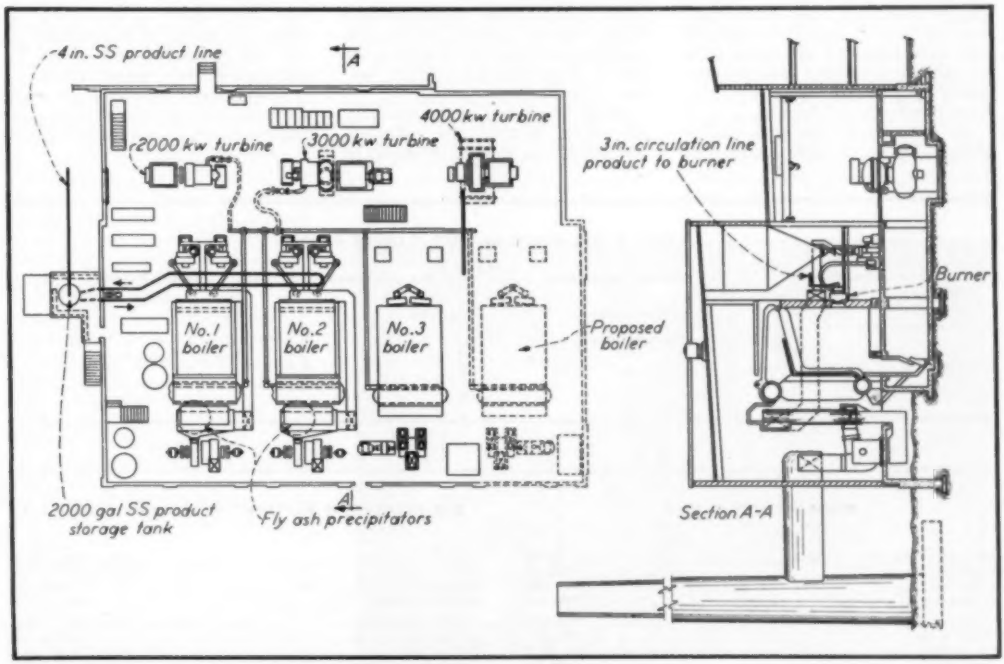
Later the holes in the burner tip were changed to 5/32 in. dia and at an angle of 50 deg. Under these conditions 24 gpm of liquor was burned continually and successfully. The plan is to burn the concentrated liquor similar to the test procedure.

Large quantities of steam will naturally be required to evaporate the water in the weak liquor. Some heat will be captured in the burning process, and it is hoped that the steam so produced will exceed the evaporator steam requirements. The entire process is a must endeavor, and it is not expected to pay out as an investment.

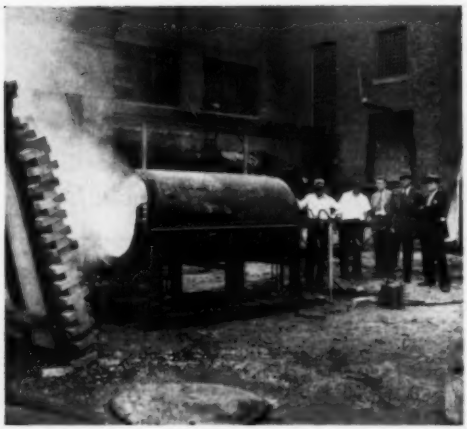
Products of combustion raised another hurdle to be overcome. The Green Bay air pollution ordinance is patterned after the recommendation of the ASME. In short it is as follows:

"No person shall cause or allow to be emitted into the open air from any fuel burning equipment, or to pass any convenient measuring point in the stack, dust in the gas to exceed 0.85 lb per 1000 lb of gases, adjusted to 12 per cent CO_2 content for the production of combustion."

For this reason, new dust collection equipment had been specified for the



Layout of the boiler plant at the Northern Paper Mills indicates the position of the new boiler with respect to the old. One original boiler of 75,000 lb per hr capacity has been equipped to burn spent sulphite liquor with a coal base



Experimental cyclone furnace constructed from an old tank and lined with brick was fired with oil and injected liquor

Boiler No. 1, which is fired with pulverized coal has been redesigned to handle the injection of spent sulphite liquor

two 75,000 lb per hr boilers. However, the furnishing company had no data on how the collectors would handle fly ash from spent liquor burning, and if the units would conform with the city ordinance. To obtain necessary data the company sent two engineers to Northern with test equipment and comprehensive samples were collected while spent liquor was burned with coal. Tests indicated that spent liquor fly ash in the form of calcium derivatives was approximately 50 per cent finer than that from powdered coal burning.

As a result of the tests radical changes had to be made in the mechanical precipitation to meet the City requirements and a new proposal was prepared. The guarantee in the revised proposal was satisfactory to the City Air Pollution Engineer and the equipment was subsequently ordered.

Evaporation and burning of spent sulphite liquor is relatively new in this country and the plant at the Northern Paper Mills will probably be the first complete installation of its kind in the United States burning calcium base spent sulphite liquor.

About 40 per cent of the spent liquor will be collected and processed. The installation is sized, however, to take much more than that percentage, and it is hoped as progress is made and "know how" developes that more can be processed and burned. It is, however, a new process and many faults will undoubtedly be found and will have to be corrected.

Inasmuch as all sulphite mills in the country are faced with the same problem, some more immediately than others, the results of this pioneer effort will be watched with interest for the practical and economic results.

Editor's Note: Since the above article was written, the installation using spent sulphite liquor for fuel has been placed in operation.

TABLE 3—TEST RESULTS ON SULPHITE LIQUOR BURNING

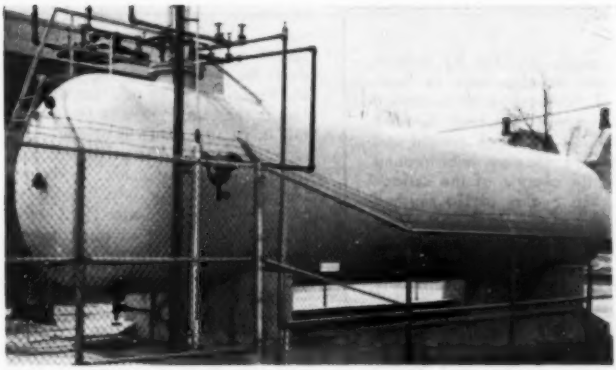
Ash analysis		*Probable combination*		*Per cent passed*		*Classified results*	
Total calcium as CaO	58.82	Calcium sulphate	56.48			Under 40 microns	85
Total sulphite as SO_3	32.93	Calcium carbonate	16.78	Screen No.		20	72
Carbon dioxide as CO_2	7.37	Calcium oxide	25.37	400	65.8	10	45
	100.00	Calcium sulphite by diff.	1.37	325	67.4	5	16
			100.00	200	87.4	True specific gravity	1.47
				100	95.2		
					13.3		

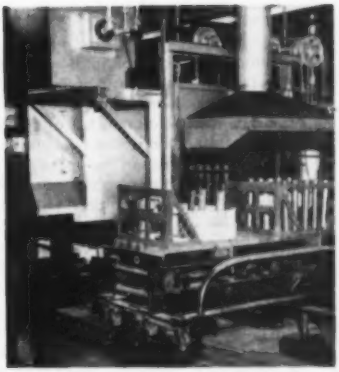
BOILER ENGINEERING DATA

Efficiency at 100,000 lb per hr	86.4%
Working pressure	700 psi
Steam temperature	700F
Furnace volume	5940 cu ft
Heating surface	9590 sq ft
Water walls	2330 sq ft
Air heaters	18,200 sq ft
Heat release	20,000 Btu

LIST OF PRINCIPAL EQUIPMENT AT NORTHERN PAPER MILLS

Boiler	Riley Stoker Corp.
Steam turbine	General Electric Co.
Water softener	Permutit Co.
Feedwater heater	Permutit Co.
Sulphite evaporators	General American Transportation Corp.
Atomizing burner gun	Engineer Co.
Dust collectors	American Blower Corp.
Consulting engineers	Sargent & Lundy





Liquid propane, stored in the company's tank, left, provides a consistent base for the RX gas atmospheres that reduce scaling and decarburization during carburizing, right, and other heat-treating operations on steel parts

LP GAS SERVES INDUSTRY

F. W. FLINSBACH, *Plant Engineer;*
H. C. HARRIS, *Metallurgist;*
International-Plainfield Motor Co.

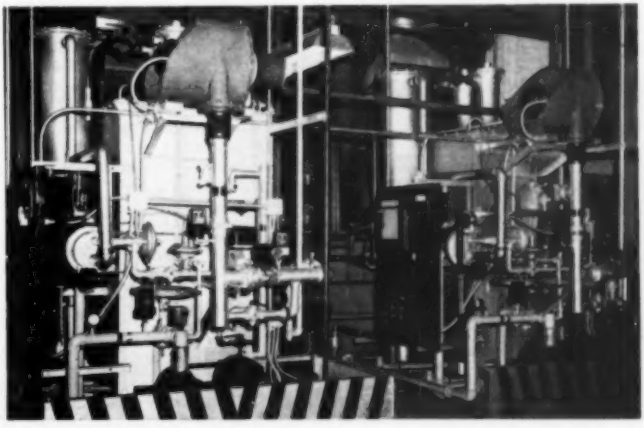
This installation, including a generator, produces furnace atmospheres that can be compounded to prevent scaling and decarburization, or supply desired case-hardening conditions

LP GAS has recently become an important factor in the production of hardened parts at the Mack Trucks, Incorporated, subsidiary factory in Plainfield, N. J. To provide for the heat-treatment of parts without subsequent machining or grinding, the company has installed (a) a modern propane gas liquid storage and vaporizing plant, (b) two radiant tube fired, tray type, pusher carburizing furnaces with washer and air draw units, (c) two radiant tube fired pit carburizing furnaces, (d) two 2400 cfh RX prepared atmosphere generators, and (3) one automatic flame-hardening machine, using propane and oxygen in the burners, for camshafts.

Since it is necessary to produce a uniform RX Gas with desired carburizing characteristics, the hydrocarbon gas to be cracked must be completely uniform. Consequently, the propane gas used is derived entirely from the artificial steam heated vaporization of the liquid. Only in emergency is the gas drawn directly from the vapor space of the storage tank where it has been generated by atmospheric temperature vaporization of the liquid.

The installation consists of a standard propane liquid storage tank with normal tank "trim" equipment; unloading equipment; vaporizing and regulating equipment. Propane can be unloaded either from railroad tank car or by motor transport at the company's election or as the source of supply dictates. General arrangement of the storage tank, vaporizing and regulating equipment is shown in the drawing.

Vaporizer. At the inlet of the vaporizer may be seen a liquid regulator assembly which controls flow to the vaporizer in accordance with the demands of the plant. The liquid regulator is set for 50 psig and vaporization takes place at this pressure. This maintains a more uniform pressure at the



Two generators form the RX base gas by catalytic cracking of a mixture of air and propane. Analysis of the base gas is modified as desired by added propane

Editor's Note: PAUL E. PEACOCK, Jr., consulting engineer and recognized authority on LP Gas applications, collaborated on the article.

Appreciation is expressed to the SURFACE COMBUSTION CORP. for data and other help on the article.

• Atmosphere control in heat-treating is made possible by modern development of tight furnaces. Concurrent developments in heat-treating include radiant tube heating of furnaces and controlled atmosphere generators. Use of special atmospheres has been directed towards: (a) prevention or minimizing of changes in carbon content and finish of the surface of the metal during forming, shaping, heat-treating and other high temperature processes and (b) change of the surface conditions as in carburizing for improving the quality of the finished product.

Heat-treating of finished parts usually calls for temperatures in the range of 1400 to 1700 F. In carburizing, rate of diffusion depends on temperature, carbon concentration gradient and the factor of diffusivity for the particular steel.

It is now an established practice in the automotive field to machine various parts completely prior to heat treatment. Thereafter they may be carburized, reheated, quenched and drawn without surface scaling and decarburization if controlled atmospheres are used.

The Mack Trucks, Incorporated, subsidiary factory in Plainfield, N. J., has recently installed the equipment described and listed herein to improve the quality of their products. As a manufacturer of engines, transmissions, rear-end assemblies and other parts for trucks, buses and fire apparatus, a major portion of this work involves the machining and heat-treating of parts such as gears, camshafts and wrist pins.

first stage vapor regulator assembly, and consequently, a more uniform discharge pressure.

At the outlet of the vaporizer, a trap is installed to prevent liquid propane from reaching the plant distribution lines. In the event of a steam supply failure, liquid entering the vaporizer would not evaporate and would pass through unchanged. When liquid propane reaches the trap, the outlet line is closed until the vaporizer assembly is manually restored to normal operation. The vaporizer normally discharges gas to a pipe line between the first stage vapor regulator and an emergency regulator near the storage tank at 50 psig pressure.

Emergency Regulator. Since normal supply of propane gas could be interrupted by closing of the liquid trap at the outlet of the vaporizer, the emergency regulator has been installed. This regulator is set for a discharge pressure of 40 psig and is normally held closed by the higher pressure output of the vaporizer. If the propane gas should fail without notice it might prove inconvenient, if not dangerous. The emergency regulator picks up the load as soon as the pressure ahead of the first stage regulator drops to 40 psig. Gas is then supplied from the vapor space of the storage tank until the normal supply is restored.

Normal Regulators. Under ordinary conditions, pressure is reduced in two stages. The first stage assembly is installed near the storage tank and reduces the pressure from the 50 psig of the vaporizer to 30 psig for distribution in the plant system by two regulators in parallel. Each is of ample size to handle the load in event one regulator requires maintenance. At the outlet of this assembly is a pressure relief valve and a pressure gage. High pressure burners are supplied directly from the discharge line without further pressure reduction.

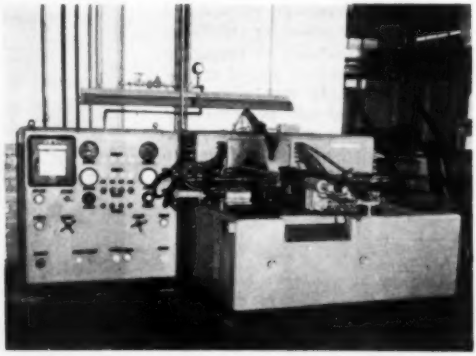
A second stage or final pressure regulator is installed as the inlet to the RX generators and other equipment requiring the propane gas at less than 30 psig. Beyond the second stage regulators, all control is assumed by the equipment and operators.

Carburizing Furnaces. The carburizing furnaces are designed for use with either of two alternate cycles in which the maximum temperature is 1700F for carburizing. One cycle requires cooling to 1100F and reheating to 1450F for quenching, the other cooling to 1525F for quenching. Variations in case depth and carbon content may be obtained by adjusting the furnace atmosphere and furnace time.

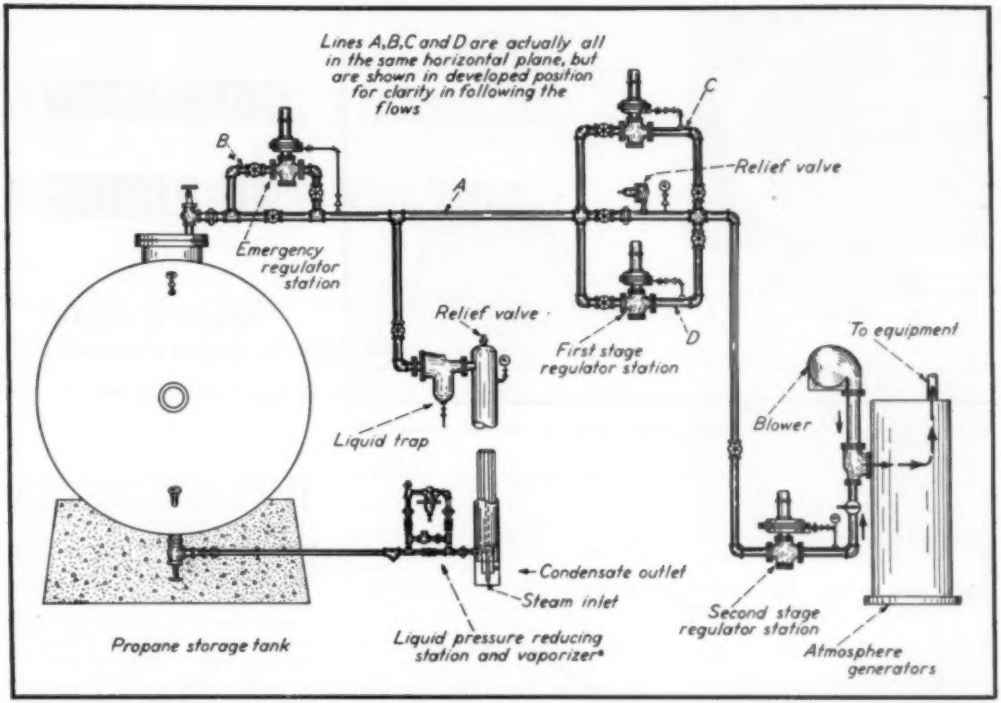
The operation of the continuous tray pusher carburizing lines is: (a) gears and other parts are carburized; (b) quenched in oil and washed to remove the quenching oil before being reheated; and (c) moved to the air draw furnaces for tempering at 400F, or as required. The wash removes quenching oil to prevent generation of obnoxious fumes in the draw furnaces.

The capacity of each of the carburizing furnaces ranges up to 1200 lb of net work plus 600 lb of trays and fixtures per hr, with a case depth of 0.040 in. Washer-rinse units and draw furnaces have the same capacity.

Pit carburizers for wrist pins and camshafts are radiant tube heated. Atmosphere is supplied from RX generators



Flame hardening machine, for selective hardening of wearing surfaces, is automatic except for loading and unloading



Normally, only liquid propane is vaporized in the steamheated unit in center to provide maximum consistency for furnace atmospheres. If unvaporized liquid clogs trap, emergency regulator provides gas from the top of the tank

Oil Quenching Unit. Immersion tube burners maintain temperature of the quenching oil as desired. The immersion tubes can also be used for cooling the oil by blowing air through them during the quenching process when the oil is apt to overheat.

Air Draw Furnace. The air draw furnace is a convection type using the manufacturers standard air heater.

RX Generator. The carburizing atmosphere for these furnaces is supplied by two 2400 cfh generators, which function by the catalytic cracking of a mixture of hydrocarbon gas and air. The reaction temperature is about 2050 F and gas produced has a nominal composition of about 24 per cent Co; 45 per cent N_2; and 31 per cent H_2. The carburizing potential of the RX base gas is increased as desired by addition of hydrocarbon gas. Control of composition of the atmosphere for the heat-treating furnaces is achieved by use of gas analyzing equipment. In general, the RX gas contains negligible amounts of CO_2, O_2 and H_2O in its analysis.

Pit Carburizers. The two pit carburizers are radiant tube heated, batch type units. Working dimensions on one are 36 in. diameter and 60 in. depth; on the other, 48 in. diameter and 72 in. depth. Atmosphere is supplied by the RX generators.

Wrist pins and miscellaneous parts are carburized in the smaller furnace with a gross basket load averaging 5000 lb. Camshafts are carburized in the larger furnace, fixture loaded with gross charges averaging 6250 lb.

Circulating Fans. Circulation of the carburizing gases is maintained by special alloy, high temperature, high speed fans to provide uniform distribution and thus uniform case depths and compositions. With the continuous furnaces, fans are located in the roofs; in the pit carburizers they are in the base. The fans are an integral part of each furnace.

Flame Hardening. After the camshafts have been carburized in the pit furnace they are hardened in the automatic flame hardening machine. The burners are fired with a mixture of propane gas and oxygen.

The automatic machine affords selective hardening of cam and bearing surfaces only. It has an electronic temperature control system actuated by radiant energy from the rotating work piece during the heating cycle, thus making possible a uniform depth of heat penetration. The unit is fully automatic except for loading and unloading of parts.

MANUFACTURERS OF EQUIPMENT — INTERNATIONAL-PLAINFIELD MOTOR CO. INSTALLATION

Propane tank	American Car & Foundry Co.
Tank relief valves	American Car & Foundry Co.
Tank "trim" equipment	The Bastian-Blessing Co.
Propane regulators	Fisher Governor Co.
Propane vaporizer	Richard M. Armstrong Co.
Unloading compressor	Ingersoll-Rand Co.
Propane valves	Wm. Powell Co.
Carburizing furnaces	Surface Combustion Corp.
RX atmosphere generators	Surface Combustion Corp.
Flamatic machine	Cincinnati Milling Machine Co.

CORROSION IN PIPING

RICHARD B. CONLAN
W. H. & L. D. Betz

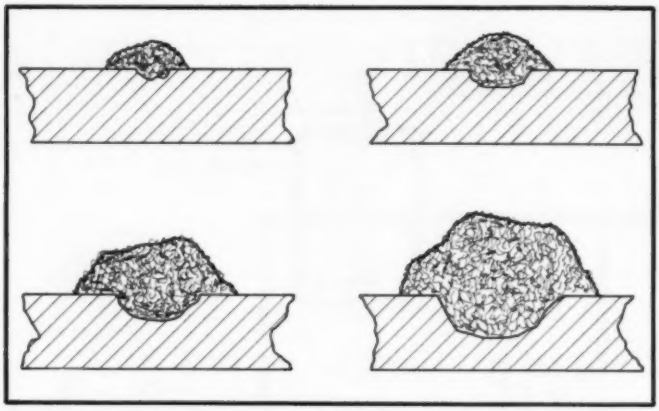


Fig. 1—Corrosive attack from oxygen usually occurs in localized, covered pits

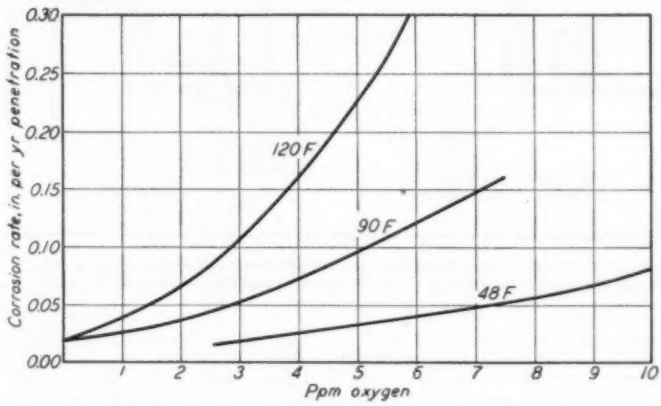


Fig. 2—Rate of corrosion increases with dissolved oxygen and the temperature

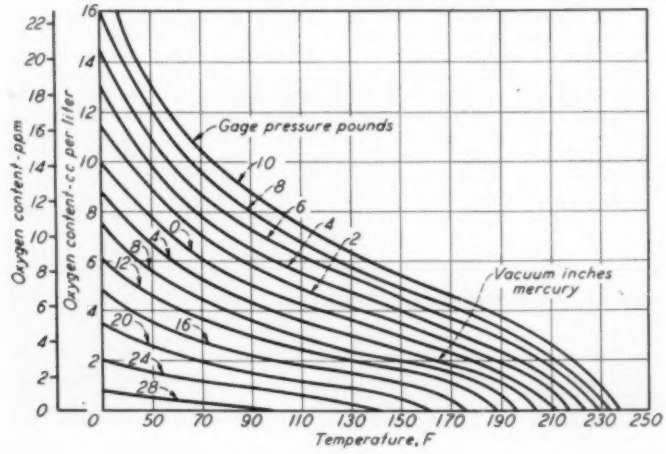


Fig. 3—Solubility of oxygen increases with pressure, decreases with temperature

BOTH STEAM and hot water have been used satisfactorily in radiant heating systems. However, hot water has definite advantages and is more widely used. For floor systems, the circulating water is usually maintained at 120 to 140F.

Scale is rarely a problem in radiant heating systems since the amount of make-up water required is very low and scale forming salts do not concentrate in the system. However, Langelier's equation, which may be found in handbooks, predicts with a reasonable degree of accuracy whether or not a water is scale forming with respect to calcium carbonate at a given temperature. It takes into consideration the pH value, calcium, total alkalinity and dissolved solids of the water as well as the temperature at which it is used. In brief, this equation permits calculation of the pH at which a water is saturated with respect to calcium carbonate at the temperature in use.

Scaling

When the actual pH value of the water is greater than the pH of saturation the water is oversaturated with respect to calcium carbonate and deposition from solution will take place. If the pH value of the water is smaller, it is undersaturated and deposits will not occur.

Scale may form a protective coating. In the absence of a deposit formation over the metal surfaces, corrosion from dissolved gases present in the water will result. On the other hand, the fact that the actual pH value is greater than the pH of saturation does not mean that corrosion will not occur unless the deposit is uniform and continuous.

Because only relatively small quantities of water need be added during

AND SCALING PROBLEMS FOR RADIANT HEATING

One of the major factors on the life of radiant heating systems is the effect of water on the piping. Here are the causes of failure and preventive measures available

operation, scale formation is not ordinarily a problem. However, difficulty will be experienced from corrosion caused primarily by dissolved oxygen introduced with make-up water, as well as from air infiltration at the pumps, fittings, valves or expansion tank.

Oxygen in Solution

Dissolved oxygen attacks ferrous metals causing corrosion and pitting. The action may be enhanced by low pH values caused by carbon dioxide and sulfur dioxide. Increases in temperature will also accelerate the corrosion reactions. Fig. 2 illustrates the effect of oxygen concentrations on the corrosion of low carbon steel specimens. Philadelphia (Delaware supply) tap water was used in these tests with a pH value of 6.7. Linear rate of flow past the test specimens was 2.5 fps. Increase in corrosion rate with increase in temperature is quite definite. Corrosion in the coils of a radiant heating system, may also restrict the flow and retard heat transfer, lowering the capacity of the system.

Generally oxygen produces an easily identified corrosion in the form of small pits or depressions, Fig. 1. As attack continues, the pit usually increases, not only in area but also in depth, and the nodule of corrosion products becomes enlarged. Detrimental effects are more severe when corrosion is localized in the form of pits than would be the case if a general overall metal wastage occurred. Centralization permits deeper penetration of the metal and more rapid failure at these points.

Prevention of Corrosion

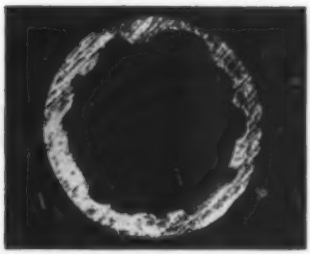
Corrosion in radiant heating systems can be controlled most effectively by use of chemical inhibitors. Chromate or nitrite may be used although, because of its stability and ease of control, one of the chromates is generally preferred.

The chemical inhibitor developes a protective film on the metal surfaces. This film is microscopic in thickness and does not interfere with normal heat transfer. By maintaining the proper concentrations of the inhibitor, the film is self-healing and maintained throughout the entire system. Where corrosion has occurred, as in an untreated system, the use of the inhibitor will stifle further attack since these chemicals penetrate surface corrosion products and form a protective film directly on the metal.

Commercial Inhibitors

One of the commercially available simple salts of hexavalent chromium may be used. They include sodium chromate, sodium bichromate, potassium chromate and potassium bichromate. The bichromate is less expensive than the chromate and is most readily available. Because of the acidic nature of the bichromate, however, it is necessary to adjust the pH value by addition of an alkaline material. To raise the pH to a range of 7.5 to 9.5, approximately 27 lb of caustic soda are required for each 100 lb of technical grade sodium bichromate.

Corrosion protection in the range of 95 per cent plus can readily be obtained with this type of treatment, provided proper inhibitor concentrations are continually carried in the system. Chromate concentrations in the range of 500 to 1000 ppm (as CrO_4) are desirable. By conducting regular tests on the circulating water, the proper additions of chemical treatment can be made for corrosion protection.



Cross-section of corroded pipe shows the deep penetration of local action

Corrosion pits from dissolved oxygen are most harmful at the threaded ends

This pipe coupling illustrates another example of failure caused by corrosion

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INDUCTION MOTOR BRAKING METHODS PICKED TO FIT THE APPLICATION

Electrical methods are often overlooked in braking applications on induction motors in spite of the inherent advantages. A study of these motor characteristics simplifies choice of the proper method for the braking control desired

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THE INDUCTION MOTOR is actually more a brake than it is a motor. Admittedly it is used more frequently as a motor, but most of its speed range has braking rather than motoring characteristics as shown in Figs. 1 and 2.

The more common electric braking methods for induction motors are plugging and regenerative, capacitor and d-c dynamic braking. Various schemes of unbalancing the motor currents are used to obtain braking torque but are not discussed here since they are seldom used on applications for the smaller motors.

In order to better understand these forms of braking, examine the speed-torque characteristics of the induction motor as shown on Fig. 2. Braking is obtained when the torque and speed are of opposite signs, or for all negative speeds and for positive speeds greater than synchronous. Operation in the negative speed range is called plugging and, at positive speeds greater than synchronous, regeneration.

Plugging is widely used as a means of braking because of simplicity of control and the large amount of braking torque obtained. In order to plug a three-phase motor, it is only necessary to reverse two of the three primary connections. Sometimes resistance is introduced in the primary circuit to limit torque obtained.

Plugging and Regeneration

In spite of its simplicity, plugging has several serious disadvantages. One is obvious from Fig. 2 which indicates that if power is not removed from the motor when it reaches zero speed, the motor will accelerate to synchronous speed in the opposite direction. Thus, the operator must be depended on to remove power at the right time unless some automatic means are supplied. In most cases, the power must be removed automatically and is accomplished under the control of a zero-speed switch.

A second disadvantage during plugging is the large losses in the motor. In stopping, they are approximately three times as great as the losses while accelerating the motor from zero to synchronous speed. In spite of this, plugging is widely used and is quite satisfactory for many applications.

Regenerative braking is obtained above synchronous speed and has the advantage of supplying high braking torque with relatively small loss in the motor. Power current is delivered to the line by the motor acting as an induction generator, although excitation must be supplied by the line.

It is apparent that a disadvantage of regenerative braking is the absence of braking torque below synchronous speed. Assuming the almost universal case of a constant-frequency power supply, regenerative braking is of no value for a single-speed induction motor except for limiting the speed of overhauling loads. Since such loads are the exception, the method is used primarily in providing positive slowdown from high to low speed of multi-speed motor applications.

Capacitor Braking

Capacitor braking is a form of regeneration. If an induction motor is driven by some means and sufficient capacitance is connected across its terminals, it will function as a generator and supply power to a load. The capacitors supply reactive power required by the induction motor and the load. Frequency of voltage generated will be roughly proportional to speed of the motor but there must be some slip in order that the induction machine may supply power.

In capacitor braking, the motor is

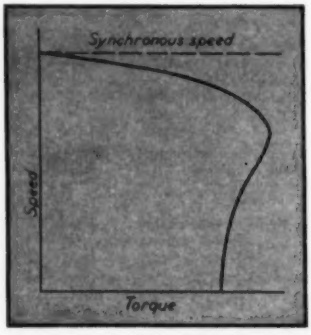

Fig. 1—Usual speed-torque curves show only motoring part of complete curve

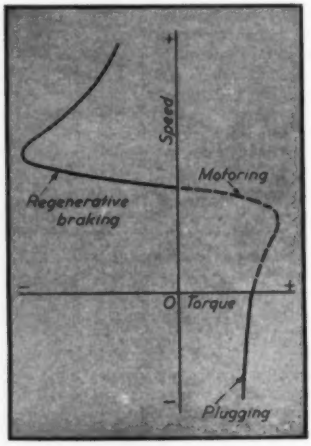

Fig. 2—(Right) Braking occurs in most of speed range of induction motors

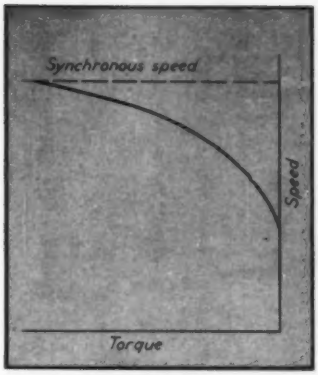

Fig. 3 — Deceleration from capacitor braking is effective at higher speeds

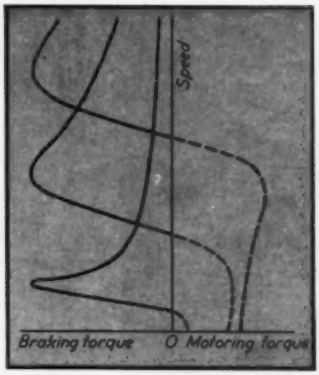

Fig. 4—Torque curve drops as frequency applied to motor terminals is reduced

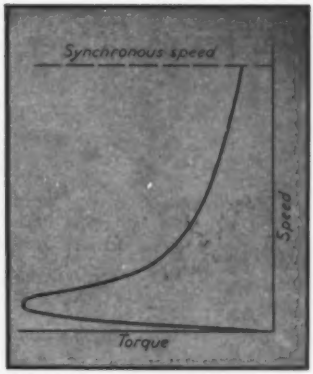

Fig. 5—D-c braking applies zero frequency power, works best at low speeds

disconnected from the line and capacitors are connected across the motor terminals, sometimes with load resistors. Braking can be obtained with capacitors across one, two or all three phases but more consistency results from using two or three phases.

High torque can be obtained with capacitor braking with relatively small motor heating. As shown in Fig. 3, torque for any one value of capacitance drops off very rapidly with speed. This is because generated voltage and frequency decrease, and capacitance required to fully excite the motor therefore increases as the speed decreases. In most cases it is not practical to try to obtain braking torque below approximately one-third synchronous speed by this method.

D-C for Low-Speed Torque

D-c dynamic braking is another form of regenerative braking. It can be considered to be the operation of an induction motor with zero frequency applied to the terminals. Fig. 4 shows torque characteristics for several values of frequency, the voltage being adjusted to maintain the same maximum torque. Fig. 5 is the speed-torque characteristic when the frequency is reduced to zero, in other words when d-c is applied to the stator. High maximum torques can be obtained with d-c dynamic braking with little motor heating. Torque is low at high speeds for motors of normal slip, making it necessary to use a high d-c exciting current if a fast stop is necessary. The scheme has the advantage of providing braking torque down to zero speed without danger of the motor reversing. Since d-c is generally not available, it is necessary to provide a source such as a metallic rectifier as well as a time relay to deenergize stopped motor.

Summary of Methods

Fig. 6 summarizes the characteristics of the various types of electrical braking. Plugging provides good braking torque down to zero speed but the motor suffers high losses and will reverse if it is not disconnected from the line when it reaches zero speed. Regenerative braking provides good torque with low motor losses although no braking torque is obtained below synchronous speed. Capacitor braking results in low motor losses. Torque falls off rapidly with speed and it is usually not practical to attempt to brake below one third of synchronous speed. D-c dynamic braking also results in low motor losses, but torque decreases rapidly at high speeds for motors of normal slip, and a d-c power supply and a time delay relay to remove excitation at zero speed are required. In most cases, one or a combination of the methods will be found to give the results desired for any of the applications usually encountered in the operation of the plant.

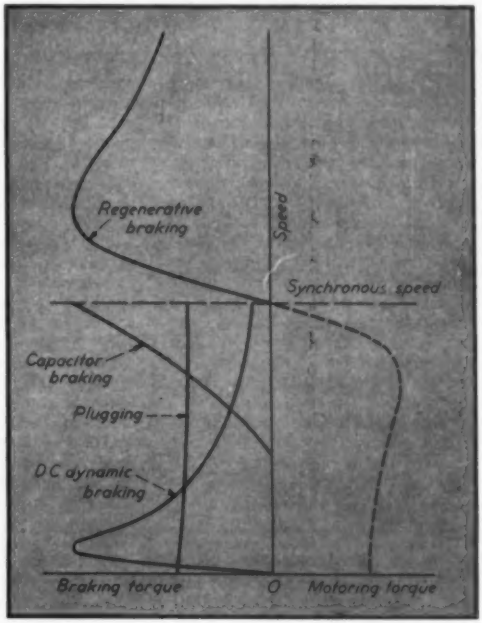

Fig. 6—Composite graph summarizes braking methods. Choice depends on speed range where highest torque is desired, heating of motor, and on cost and availability of auxiliary equipment and power source

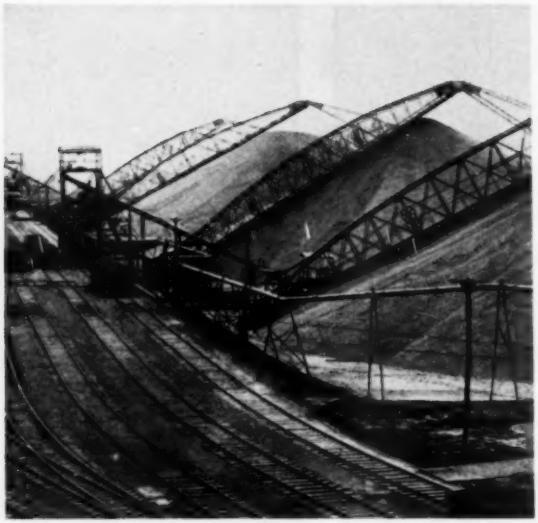

Fig. 1—Free-flowing anthracite can be stored in conical piles. Conveyors discharge just above peak, reducing breakage. Pivoted conveyor on screen tower returns coal to cars

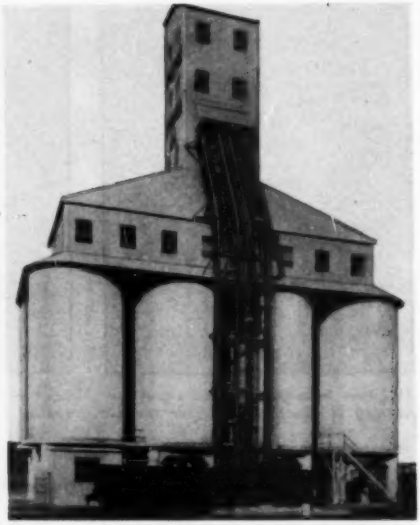

Fig. 2—These multiple monolithic concrete silos are for gravel, screened before distributing to bins. Often used for coal, etc., interspace may provide extra storage room

METHODS OF STORING BULK MATERIALS

How storage operations vary with characteristics and quantities of granular and lump materials

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PROBLEMS in bulk storage range from those relating to capacities of a few hundred ton to those involved in the enormous quantities maintained by the producers and large consumers.

For bin storage of materials, the reinforced silo, Fig. 2, has long been favored. Where required capacity is too large for a single unit, several are spaced about a foot apart with connecting walls which form a fifth usable space for each group of four.

Silos for boiler house coal supplies cost less than framed steel or suspension bunkers. As a rule diameter is less than 30 ft and, to reduce packing, height is moderate—60 ft or less.

Fragile materials, such as briquettes, make it desirable to introduce the load at points just above the peak of the pile. This can be done readily with the continuous flow elevator by using spaced openings as shown in Fig. 3. With a bucket elevator, breakage can be minimized by a stepped chute (or trickler) or by a spiral, both illustrated in Fig. 5. Similarly, breakage caused by converging outflow may be reduced by a square vertical box chute (about 24 x 24 in.) with inwardly swinging trap doors. Thus the outflow is always close to the level of the material in storage. The device was originated to reduce degradation in sized anthracite storage pockets.

Fig. 4 shows a 30,000 ton capacity partitioned rectangular storage bin for Florida pebble phosphate. This costly structure was justified by the necessity of loading the material into trains of cars on four tracks simultaneously whenever the dryers had filled the bins. Multiple silos would be substantially lower in cost where their unloading means are satisfactory.

Overhead bunkers usually are preferred for boiler house coal storage because the contents are kept warm and the coal may flow directly by gravity to the stokers or pulverizers. Also, if there is a horizontal runaround conveyer or a larry, any coal with undue heating may be continuously withdrawn until the emergency is passed.

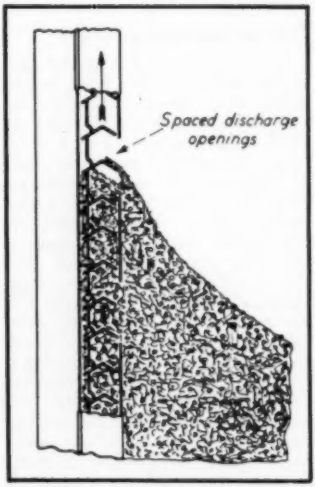

Fig. 3—Discharge level of continuous flow elevators is kept near top of the pile of material by spaced openings

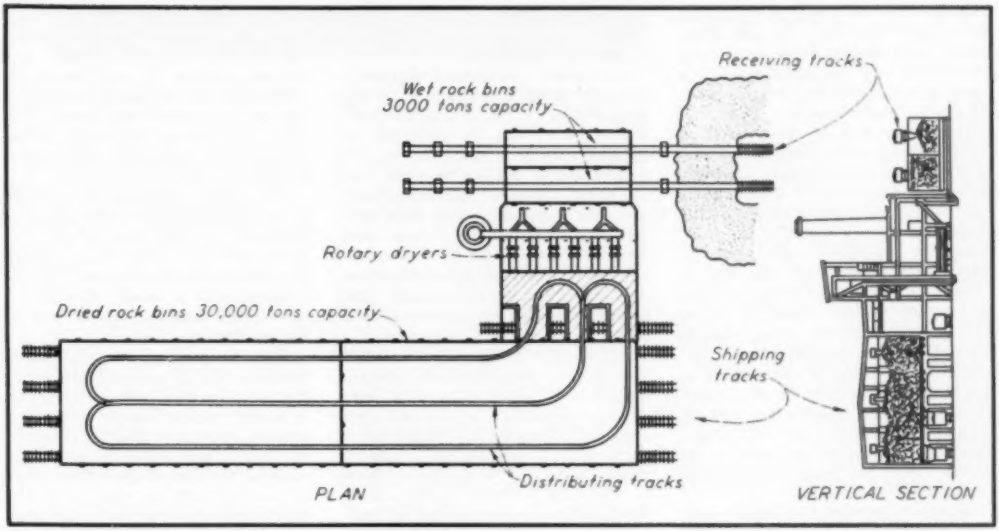

Fig. 4—30,000 ton capacity concrete structure designed to dry, store and load pebble phosphate. The material passes through six rotary dryers and is elevated and distributed into storage by automatically loaded and discharged cars. Trains on the four ground level tracks must and can be loaded simultaneously when bins are filled from dryers

Overhead bunkers in order of progressively lower first costs are: (1) concrete; (2) framed steel with gunite lining; (3) framed steel protected with a ¼ in. thickness of bitumastic enamel; (4) suspension type steel plate similarly protected and (5) the suspension type formed by corrugated sheet steel resting on steel straps spaced on about 3 ft centers, with 2 to 4 in. of gunite lining. Even the last, if supports are included, costs more than a silo of corresponding capacity.

With the current use of smaller bituminous coals (⅜ in. and smaller), the problem of overcoming its obstinate resistance to flow when damp or sticky is not yet satisfactorily solved. Generally coal is wet, either from washing or rain. When dry, the angle of repose is about 35 deg. With increasing surface moisture this becomes 60 deg, or even 90 deg after being compacted by pressure in storage.

Drying at the rate coal can be handled from cars requires too costly an investment. A dryer of 20 ton per hr

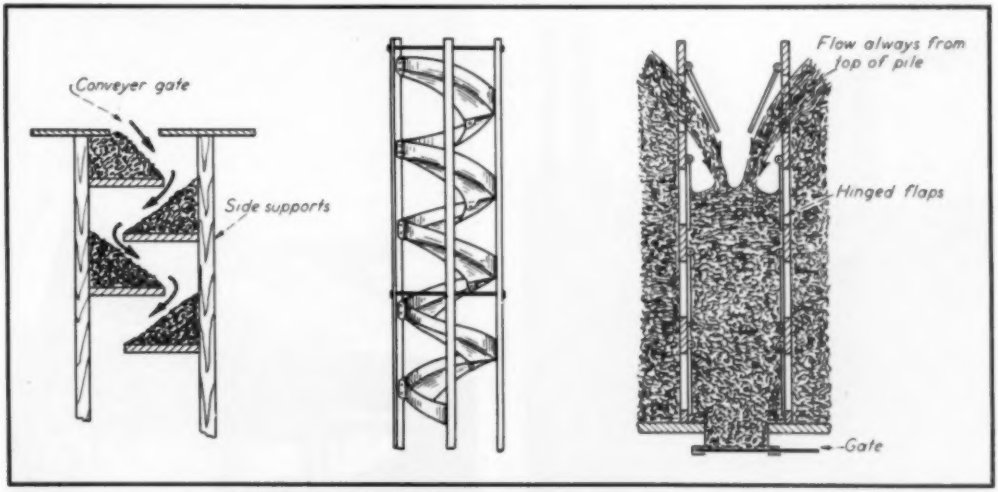

Fig. 5—Various ways of slowing fall of fragile material from bucket elevators include the stepped chute, left, and the spiral chute illustrated in the center. Designed to reduce breakage by converging outflow, box chute, right, has spaced openings covered by hinged flaps which cause the flow of material to be always from the top of the pile

capacity with its auxiliary equipment costs about $30,000. On the other hand, coal might be stored in an open roofed bin and rehandled through a dryer at a reduced rate, which would, of course, double handling costs.

Another possibility is to purchase lump coal and crack it to minus ⅜ in. at the plant by hammermill. Crushing reduces *surface* moisture which causes the trouble. For example, assume a high degree of surface moisture in 3 in. lump size, which has surface area of 500 sq ft per ton. If the coal is crushed to ⅜ in. x 0, the exposed area is increased to about 4000 sq ft per ton, and the resultant average surface moisture of the crushed product becomes so low that the coal will flow freely. Surface moisture is determined or expressed as so much per unit of weight, which does not change appreciably. Flowability depends on the moisture per unit of surface area, which is improved by crushing.

However, raw coal in small sizes may be bought at $3.10 per ton, or $4.50 per ton if washed. 6 x 3 in. lump will cost about $4.85, plus the cost of crushing. Whether or not it is worth while depends on how critical the emergency becomes. A compromise is to mix crushed lump with the damp small size coal to the extent necessary to make it flowable.

Reserve storage of coal at or near the steam plant is a universal practice. To take coal from cars or barges to ground storage and rehandle it to cars or bunker, doubles and sometimes trebles the labor cost. The largest bunker capacity consistent with the investment is desirable.

Last winter's unpleasant experience emphasized the importance of a very large reserve. If this is near the plant, dust nuisance can be controlled by spraying with oil or emulsified asphalt.

Spontaneous heating of some coals in ground storage has been brought under control by compacting with track type equipment as in Fig. 6. Some years ago, for example, the Dow Chemical Company maintained waterside storage with coal piled loosely by crane. Loss through spontaneous combustion was heavy.

Procedure was changed and coal is now spread by bulldozer and carryall. Smoothed out in layers 5 or 6 in. deep, voids are removed before the next layer is placed. When the pile has reached a depth of 30 ft or so, the top is rounded to shed water. Air circulation has been so completely prevented by this process that there has been no instance of heating since it was adopted.

Cost of stocking out from dock to pile, including labor, maintenance, chargeoff in five years, levelling and compacting, is found to average about 4 cents per ton for a tonnage of 400,000. Rehandling to cars costs about the same, except when partly frozen coal requires a bulldozer.

Where compacting is not involved, drag scraper equipment is often lowest in first cost. It is available not only for coal but, with modified bucket, for sand, limestone, gravel and ores weighing up to 100 lb per cu ft. For larger capacities, the haulage machine has remote-controlled drum brakes and clutches, operated by small motors located at the side of the frame. Operating skill is attained more readily than for a crane, shovel or carryall. Where operations are seasonal, ropes are removed and stored.

The great travelling or pivoted bridge installations for unloading and reclaiming ore and coal are less frequent than formerly. The modern crane with hydraulic controls, with the cooperation of a carryall, piles and recovers bulk materials at a fraction of the investment.

Ground storage of materials such as sand, gravel and crushed limestone by trestle and inclined belt conveyer, Fig. 7, usually with reclaiming conveyer in a tunnel beneath, is favored, especially for construction work. For recovering material from the pile, bulldozers move the material into the range of gravity flow. However, trestle-and-tunnel storage has objectionable features for coal.

In the anthracite field, storage has long been a "must." The demand is seasonal, so throughout the summer months the coal is stocked out in conical piles and reclaimed in the fall. Some years ago there was no call for sizes smaller than pea, and tremendous culm banks built up alongside each preparation plant. Then came the demand for cheaper small sizes—No. 1, 2, and 3 buckwheat, and rice. For reclaiming these and other large masses, the carryall towed by tractor, is used.

Fig. 6—Spreading coal in layers in a ground storage pile eliminates air pockets which permit spontaneous heating

Fig. 7—Trestles and conveyers may be used for ground storage, and often have reclaiming conveyer in tunnel beneath

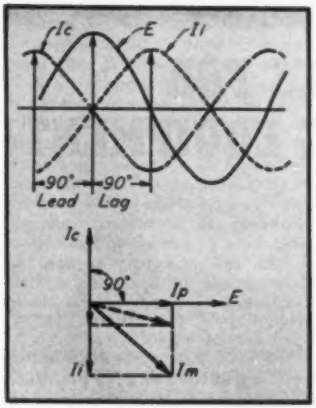

Fig. 1—Capacitor current neutralizes inductive component, reduces line kva

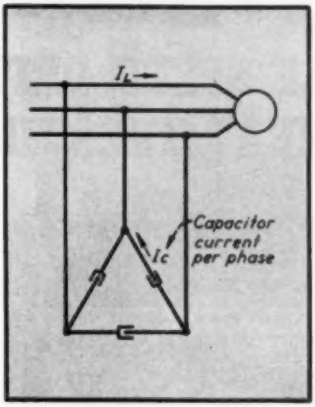

Fig. 2—Equal division of capacitors on each phase maintains load balance

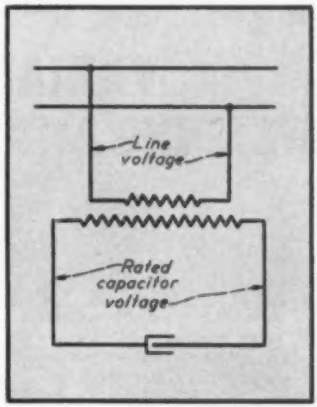

Fig. 3—Transformation may help get full capacity from high voltage units

EMERGENCY CAPACITOR USE ON BRANCH CIRCUITS

POWER factor correction is normally applied at the substation or main bus. However, emergencies often overload the branch circuits, and capacitors used judiciously at the load end may reduce the current to the safe rating of the circuit.

Being small static units, capacitors can be enclosed for safety, conveniently located near the load end of a branch circuit and connected across the terminals by a temporary line. Normal handling precautions* should be observed.

Principles of correction on all loads are the same. An inductive current, I_m in Fig. 1, may be resolved into the load component, I_p, useful in supplying power and the inductive component, I_l, which only provides the magnetic fields necessary for motor and transformer operations, and lags the alternating voltage by 90 deg. Capacitor current, however, is 90 deg ahead of voltage or 180 deg ahead of the inductive component, which it neutralizes, ampere for ampere, in the supply line.

At 0.95 power factor (approximately 17 deg lag or lead, as for the dotted vector, Fig. 1) the vertical component is about 30 per cent of the total current. Normally, the extra 30 kvar of capacitors needed per 100 kva of load for complete correction is not economical; but for small loads, capacitance added may vary as much as 60 kvar per 100 kva of load and still reduce current to within 5 per cent of the possible minimum.

The kvar of the capacitors required for correction and the resulting load kva for each 100 kva of uncorrected load is, approximately:

Original pf	kvar for pf=1	kvar for pf=.95	kva at pf=.95
0.60	80	50-110	63
0.70	70	40-100	74
0.80	60	30- 90	84
0.90	45	15- 75	95
0.95	30	0- 60	100

For example, a 100 hp induction motor operating near full load at 0.80 pf draws about 100 kva. If it fails and the only satisfactory substitute available during repairs is a 150 hp motor, the line may be overloaded. Operating at two thirds capacity, the replacement would have lower power factor, say 0.70, and efficiency and would draw 20 kva more power. The total input of 120 kva could be reduced to 1.2 x 74 (from table) or 89 kva, well within the original value. To achieve this, the kvar range of capacitors could be from 1.2 x 40 or 48 to 1.2 x 100 or 120 kvar.

Power factor readings taken before and while making corrections are most desirable. The clamp-on type of meter is portable and easily used. However, capacitor units may be simply connected across the line until the load current, as read on an ammeter, reaches its minimum value.

For three phase power, the units must be equally divided, between phases, Fig. 2, to keep the load balanced.

Higher than rated voltage applied to capacitors is very detrimental and should be avoided. On the other hand, the actual kvar drawn by capacitors varies as the square of the voltage applied, and a 460 v, 15 kvar unit on a 230 v line would operate at 1/4 capacity or only 3-3/4 kvar. For relatively small loads, extra units if available may be the simplest answer. A transformer, Fig. 3, may also be used to increase (or decrease) line voltage to rated value for the capacitors so that they will draw rated kvar from the line.

Do not connect capacitors to the *load* side of a frequently operated switch such as a motor starter. High current and voltage surges occuring each time the switch operates will quickly ruin both contacts and capacitors. Always use the proper capacitor discharge resistance for safety on temporary installations.

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*"*Capacitor Care That Saves Money,*" INDUSTRY AND POWER, Feb., '51.*

VARIABLE SPEED DRIVES FOR WELDING AND HEAT TREATING EQUIPMENT

FRANCIS A. WESTBROOK

VARIABLE speed drives often increase efficiency and versatility of welding and heat treating machinery. A few practical applications are shown here. Modern continuous or rotary furnaces, frequently designed to reheat for hardening, annealing, tempering, hydrogen annealing, normalizing, bluing and coating need accurate speed adjustments to be adaptable to the varying requirements of these processes, and for various shapes.

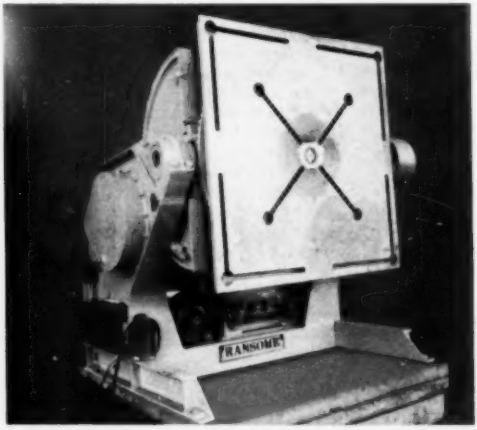
Thus a continuous clean hardening furnace installed in a well-known New England plant handles a variety of parts from steel pen points to bolts 2 in. in diameter by 8 in. long, and has a capacity of 300 to 600 lb per hr. A motorized variable speed drive is applied to the conveyer mechanism which carries the parts through the furnace at whatever speed is desired, thereby assuring uniformity of heat treatment.

Although many heat treating furnaces have variable speed drives as standard equipment, there are still large numbers without means of speed regulation. When an increase in the variety of work to be handled is desired, it may usually be accomplished by installing a variable speed drive.

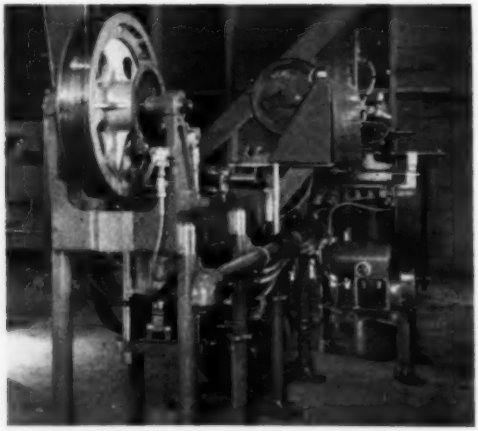
In welding operations it is also frequently advantageous to use devices which can be run at different speeds. For instance, one of four identical tank rolls used to turn cylindrical vessels up to 15 ft long and 12 ft in diameter, and made of about ¼ in. plate is equipped for close speed control. In this way, the speed at which the rolls are driven is varied in order to secure the proper peripheral speed, which is usually the welding speed, of whatever size of vessel is being welded.

The unit consists of a variable speed drive coupled to a gear reducer, furnishing speeds to the input shaft of the latter from 346 to 1038 rpm. The output shaft of the reducer drives a shaft on which the rubber tired wheels of the tank rolls are mounted, turning the tanks at any desired peripheral speed between 40 and 120 ft per hr.

Variable speed controls are used in resistance welding applications primarily to adjust for different conditions in welding materials of different gauges. For example, on flash welders one platen is stationary and the other is moved toward it under carefully regulated conditions to provide the proper temperature gradient in the weld zone at the moment of upset.

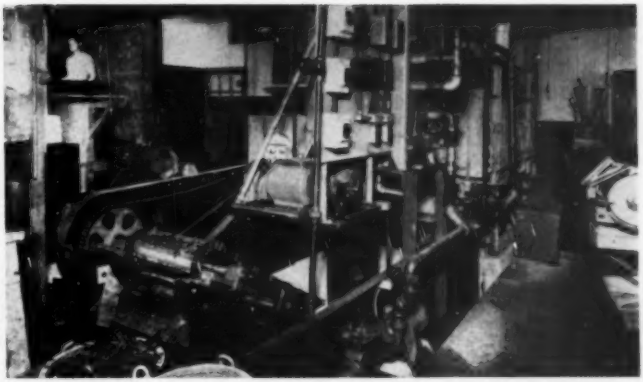


Positioners locate weldments so that operator can weld in the downhand position, allowing higher currents and welding speeds. On circular welds, a variable speed drive adjusts for the maximum usable travel rate regardless of radius of rotation. The "tilt" drive is motor operated on the larger units. Pushbuttons control start and stop

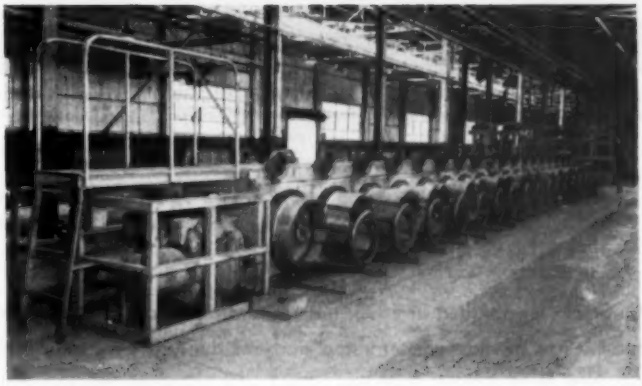


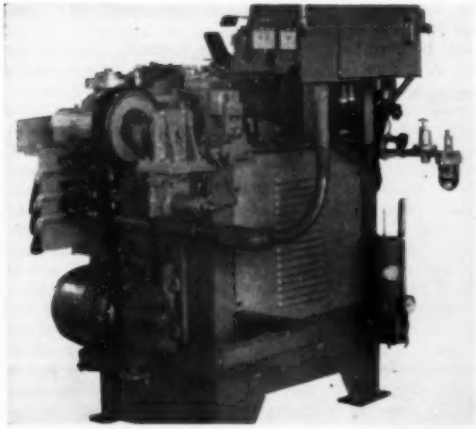
A steady speed, capable of being adjusted, is essential in realizing maximum possibilities from automatic arc welding. This "flying loop" inert gas welder for production of thin welded tubing uses a combined variable speed and gear reducer drive to control tube speed for the best heat-time relationship for varying thicknesses

This continuous hardening furnace for small parts discharges the heated pieces into the oil bath in the center foreground. The hardened parts are removed from the oil quench tank by the motorized conveyer at a constant rate. Because minimum quench time is important in determining the hardness and toughness of the parts, the variable speed unit incorporated in conveyer transmission permits the combination of maximum production, minimum handling and uniformity of metallurgical characteristics. Heating time in furnace is also commonly determined by the rate at which parts are carried through it. The rate, in turn, is controlled by the conveyer speed, adjustable to any value desired

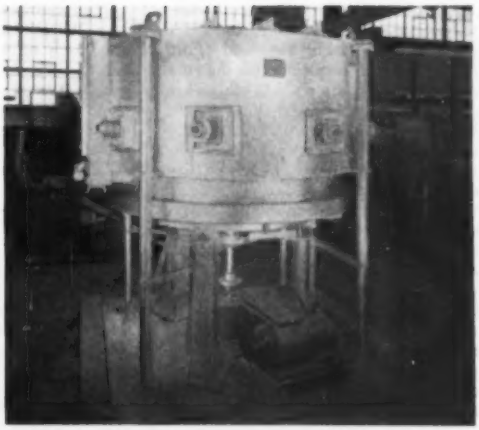


The take up drive for a wire annealing furnace handles eighteen coils on each side of the machine. There is a worm gear speed reducer at each coil. Each side is driven independently by a 10 hp motor through the variable speed unit. In this way, the length of time that the wire is in the furnace may be adjusted according to the size and kind of wire being annealed, thereby varying heating time to meet the varying metallurgical conditions encountered. It is also possible to operate the two sides of the machine at different speeds when two kinds of wire are being treated. Output speed of the motors and associated transmission units may be set for any value between 93 and 426 rpm

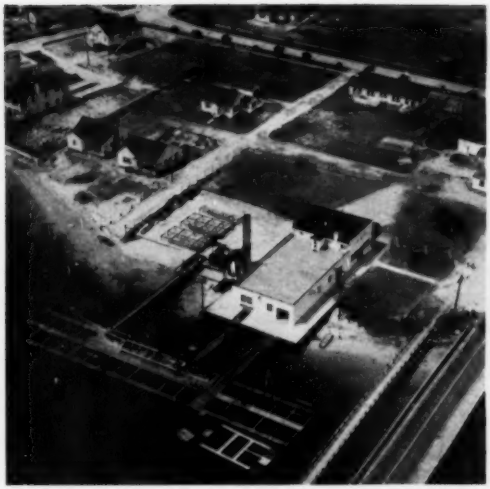




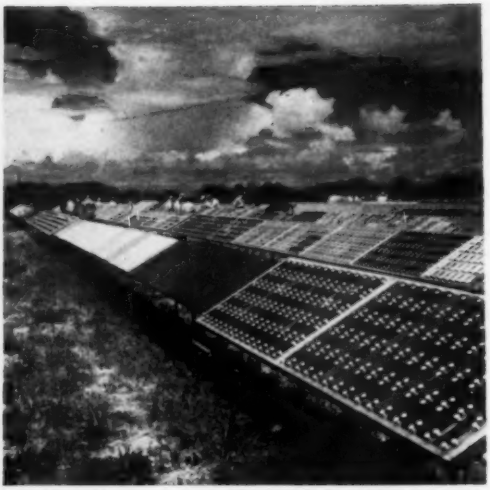
Platen speed and other variables, except current, are controlled by contour and speed of cams in this type of flash welder. Speed control is important in obtaining proper temperature gradient in the weld zone, particularly when sizes, shapes and materials vary. Here, variable pitch pulley and motor on adjustable base are used



Variable speed drive on this rotary hearth furnace gives heating cycles between 4 and 12 min to provide the proper soaking time for various sizes and alloys in heating for forging operations where uniformity is very necessary. Although only 4 ft in diameter, capacity of the furnace is 900 lb per hr of metal at temperatures up to 2100 F



Underwater testing laboratory is located on Harbor Island where the water is free of pollution found near many cities



Atmospheric test racks at Kure Beach support the specimens on insulators, which can be rearranged for different sizes

OCEAN TEST TUBE GETS NEW EXTENSION

Originally established in 1935, this marine laboratory increased its facilities to provide uninterrupted study of the resistance industrial products have against corrosion attack in a salt-water environment

SINCE ABOUT 1921 The International Nickel Co., Inc. has devoted considerable time and effort to the study of corrosion and the corrosion-resisting properties of nickel and its alloys, as well as other industrial materials. These studies led to the erection of a marine laboratory at Kure Beach, N. C. in 1935 to compare the corrosion resistance of low-alloy steels with carbon steel. Continuing extensions now provide for studying all kinds of ferrous and nonferrous metals and alloys; metallic and organic coatings, including anti-fouling formulations; the effects of marine growth on wood and metals; and the results of exposure to sea spray and air on rope.

More than 100 companies are cooperating in the work, with many of the specimens representing materials that require special processing. Facilities have been provided for cleaning and weighing samples before and after exposure, and for microscopic examination and measurement of pit depths and other forms of damage not disclosed by weight loss.

One atmosphere test lot, located about 700 ft inshore, has room for 40 racks, each of which will hold from 700 to 900 specimens. At present, over 20,000 are undergoing tests. Another rack standing about 80 ft inshore holds specimens undergoing tests combining salt-water spray and sea air. Close proximity to surf breaking on the beach makes corrosive conditions very severe — some steels corroding ten times faster than those in the previously-mentioned lot.

All testing is essentially a cooperative effort involving Inco and other producers as well as users of materials. Information and data derived from the studies are exchanged and publicized through engineering societies interested in corrosion problems. Engineering groups are invited to visit the laboratory each year to learn of progress made and discuss corrosion.

Sea-water immersion tests, originally conducted at Kure Beach have been transferred to Harbor Island, fifteen miles further north. Among the many advantages of the new site are: (1) a good supply of full-strength sea water uncontaminated by industrial wastes, oil or other pollutions, (2) wide range of sea-water temperatures—45 to 85F, (3) a large number of sea organisms and long season of growth, (4) protection against storms and high waves, (5) good fluctuation of water level with tides.

Underwater corrosion includes the study of anti-fouling characteristics of metals, alloys, plastics and various kinds of protective coatings under the direction of Dr. William F. Clapp of the William F. Clapp Laboratories, Inc.

The need for more precise information on the abilities of alloys to withstand severe erosive effects when used in condenser tubes, piping systems, pump impellers, propellers, etc. has led to the development of several pieces of testing apparatus. In these devices, bar and tube specimens are whirled through violently agitated sea water at high velocities, while others in the form of rotating discs permit the study of velocity gradient from center to periphery.

An aspirator jet subjects specimens to the erosive effects of high-velocity jets of sea water mixed with air bubbles. It has been particularly useful in developing and evaluating condenser-tube alloys resistant to impingement attack. Another setup consists of a

Battery of cells designed to study potential relationship and polarization characteristics of various metals, alloys

Steel piling is given cathodic protection from current generated by magnesium anodes to supplement various coatings

battery of cells designed to study potential relationships and polarization characteristics of metals and alloys in sea water flowing at different controlled velocities. These investigations are yielding fundamental data concerning the behavior of galvanic couples.

Other effects of velocity are being studied by practical trials of full-scale units such as oil coolers, with provisions for testing models to permit studies of changes in materials and design as a preliminary to full-size construction. The use of full-size units has the advantages over ordinary shipboard trials that operation can be made continuous or to follow any desired cycle, and the conditions of use can be altered at will to suit the requirement of the test program without the restrictions imposed by shipboard operating conditions.

As a continuation of the full-scale tests of marine piling at Kure Beach, advantage was taken in building the new underwater rack structure at Harbor Island, to make each pile serve as a test piece.

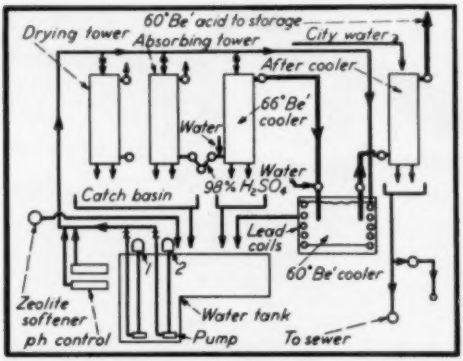
In addition to timber piles treated with different preservatives against marine borers, the steel piles were given several types of protection against corrosion. They range from modern organic coatings through hot-dipped and sprayed metal coatings to Monel and cupro-nickel sheathings, which are applied to the critical tidal zones by different means such as integral cladding, and welding or mechanically fastened wrappings. A number of metal piles are cathodically protected with magnesium anodes as a supplement to the other means of protection.

Many other materials under test also serve utilitarian purposes. For instance, the laboratory building roof consists of 0.025 gage Monel sheeting, and the enclosing fence is in two sections — one made of 18-8 stainless-steel and the other galvanized-steel wire.

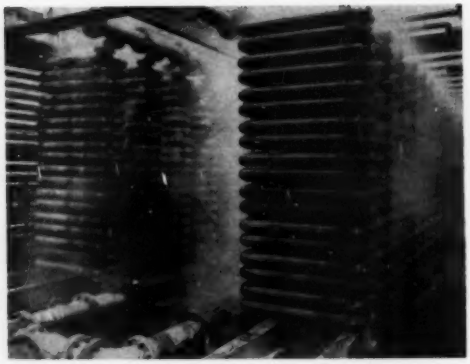
New specimens of certain key materials are put on the exposure rack each time a large group is removed, or a new group installed. These provide information on changes in the corrosiveness of the atmosphere from year to year and assist in interpreting tests made over different periods.

Special attention is given to the filing of data and they are tabulated on standard forms to provide a record of the conditions under which the information was secured. During the past 25 years, some 35,000 data sheets of this type have been accumulated and filed. A dark room facilitates processing the large amount of film consumed in providing a photographic record of the many tests and specimens.

The laboratory building at Harbor Island contains a marine museum where interesting sample specimens from the many studies are stored for quick reference



City water, flowing over three cast iron cooling sections and into a cooler containing lead coils, is held at 6.5 pH



Sulphuric acid is cooled in two sets of 18 cast iron sections, 15 stacks high, with a sprayed treated water bath

RECIRCULATED WATER COOLS ACID

New cooling sections, sprayed with treated recirculated water, increased efficiency, reduced maintenance costs and hold sulphuric acid temperature exactly

J. T. ROEBUCK,
Plant Superintendent

MARION MFG. CORP. of Indianapolis, Ind. has adopted a method of cooling sulfuric acid with a combination cooler and cooling tower that is new to the industry. It has solved the problem of ever-increasing water hardness and has reduced operating cost. The plant, originally designed for 160 ton per day, now produces 230 ton daily of 60 deg Bé acid by the Leonard-Monsanto contact process.

This new cooling system is employed for cooling 98 per cent acid from the drying tower and absorbing tower. It consists of two sets of cooling sections each having 15 stacks of 18 National Radiator cast iron cooling sections, connected for parallel flow of absorbing tower acid and drying tower acid. These stacks, spaced on 28 in. centers, are supported 13 ft above ground level and rise to a height of 23 ft. The cooling sections are supported by a steel structure approximately 48 ft long and 18 ft wide. Sections are made of the highest grade cast iron and have internal fins which provide a maximum rate of heat transfer.

Cooling water is supplied by a recirculating system, which also services two other coolers. One of these is a separate cooling section for an intermediate product of 66 Bé that results from dilution of the cooled absorbing tower acid and consists of three stacks, 14 sections high, arranged for parallel flow. The other is an existing submerged lead coil cooler for the end product of 60 Bé that results from dilution of the cooled 66 Bé acid. These four coolers are supplied with cooling water from a common water tank by two pumps. Water returns to the tank by gravity from two catch basins under the three coolers and from the lead coils. An after-cooler, consisting of 32 sections arranged in two stacks of 16 sections each in series, completes the cooling and delivers 60 Bé acid at 90 F to storage tanks.

Originally, the cooling system was designed to operate on once-through well water. But, cooling became increasingly inefficient because an insulating scale was built up on the cooling sections from minerals in the water.

By using treated city water in a recirculating system, increasing the cooling surface to allow for a higher cooling water temperature and spacing the stacks to improve air circulation, greater cooling was accomplished. Evaporative cooling occurs on the surfaces of the cooling sections, which are arranged to permit a free air flow, and from the heated water as it falls from the bottom of the stacks to the catch basins 13 ft below.

Make-up water is economically treated to prevent scaling and corrosion. Water is given Zeolite softening and the Betz Dianodic corrosion inhibiting treatment. The latter consists of a controlled ratio of phosphate and chromate inhibitors in low concentrations producing a pH of approximately 6.5.

The 98 per cent sulfuric acid normally enters the cooling coils at 180-190 F and flows at a ratio of 300 gpm through each of the parallel banks. Maximum temperature of the entering acid may be as high as 240 F. The designed outlet temperature is 140 F for the drying tower acid and 150 F for the absorbing tower acid without allowing for the cooling obtained by evaporation during free fall of the water to the catch basin. Actual acid temperature on leaving the coolers has been 120 F in winter operation. In this system, approximately 8 ton per hr of 66 Bé acid are cooled from 220 to 140 F and 10 ton per hr of 60 Bé acid are cooled from 260 to 130 F.

To produce these temperature reductions the system was designed for a water flow rate of 1000 gpm with a calculated make-up of 40 gpm. Storage capacity is 8000 gal but 5000 gal of water was being maintained for circulation. Circulating water temperature was 85-90 F and make-up water entered the softeners at 60 F from the Indianapolis city water system. The system was designed to run with an average water temperature as high as 125 F on the sections during the summer. In the event of failure of the city water supply, well water is still available for cooling purposes.

MAINTENANCE 'KNOW HOW' MEANS EFFICIENT BATTERIES

- Add approved water to battery at regular intervals
- Keep the battery case clean, dry and free of acid
- Maintain correct charge, but do not over charge
- Check specific gravity of electrolyte and voltage with accurate instruments. Record all data including water additions on permanent charts for filing

E. F. GROTHE, *Operating Engineer*
The Electric Storage Battery Co.

First step in care of batteries is the regular checking of electrolyte sp gr

VERY OFTEN the difference between a winning and a losing team in the field of sports is the reserve strength. When the stars are forced out of play for any reason at any time, the team's performance is the responsibility of the men on the bench. Until such an emergency occurs no one pays much attention to the man behind the man. However, a successful coach realizes the importance of reserves in sports, as the successful operating engineer realizes the importance of auxiliary equipment in operating a plant.

For instance, the storage battery is often just another item of auxiliary equipment held in reserve for an emergency. During service interruptions in central stations or substations the battery must take over the function of key equipment on a moment's notice. Consequently, the "coach" of the power plant team should understand this vital "reserve player" and keep it in the "pink" of condition, ready to join the line-up when needed. Of course, this requires a knowledge of the basic principles of storage battery operation and proper maintenance procedure.

Chemical Energy

Although design refinements over the years have led to longer life, increased ruggedness and reduced maintenance, the modern storage battery operates on the same basic principle and uses the same electrochemical reaction as did its predecessors. Energy is put into a storage battery as direct current electricity, stored as chemical energy and delivered as direct current electricity when discharged. This process is indicated in lead-acid cells by a change in the composition of the plates, the specific gravity of the electrolyte and cell voltage.

Each cell is made up of one or more brown (positive) plates sandwiched between gray (negative) plates. To prevent mechanical contact, and thus provide insulation, porus sheets (separators) made of some non-conducting material are inserted between the plates. Separators are porus to permit free passage of electrolyte. The plate assembly, called an element, is placed in a glass or hard rubber jar and immersed in a dilute solution of sulphuric acid (electrolyte).

Plate Composition

Framework for both negative and positive plates is a lead-antimony lattice work or grid. Lead compounds in paste form, called active material, fill the open grid areas. The positive plate contains lead peroxide (PbO_2), while the negative plate contains spongy lead (Pb). As long as these two plates are dissimilar and immersed in the electrolyte, direct current will be produced when they are connected to an external circuit. This is called discharging. During discharge, the chemical action forms lead sulphate ($PbSO_4$) on each plate, the specific gravity of the electrolyte decreases and the cell voltage drops. Current ceases to flow when lead sulphate forms to the extent that both plates no longer contain different material. Both plates and electrolyte can be restored to their original condition by charging. This is accomplished by sending a current through the battery from the positive to the negative leads. The charging current flows in the opposite direction to the discharge current.

Clues to a battery's condition are color and appearance of the plates, specific gravity of the electrolyte and cell voltage. Another guide is the

Obtaining cell voltage is a simple yet important step to good performance

Cells should be filled with approved water stored in non-metallic containers

Protection of metal elements starts with a dry battery top. Spilled acid will not evaporate and results in corroded parts

Repeated visual checking of the electrolyte is possible in glass jar batteries. Maintaining liquid level is necessary

amount of water required from time to time. During the charge excess current decomposes the water in the electrolyte (not the acid) into oxygen and hydrogen gases. Gassing or bubbling occurs toward the end of charge. If it occurs early in the process, the charge rate is too high and should be reduced. Inaddition to water lost by gassing, some is lost by evaporation. However, when cells have sealed covers the loss by evaporation is small compared to that lost by electrolysis on charge.

Water Loss

Since water loss in sealed-cover cells depends upon the amount of charge, and this upon the extent of discharge, the water added varies with the size and service of the battery. As an example, an automobile equipped with a six-volt, 45-plate battery and driven 1000 miles per month would require not more than one-third pint of water. If more than this is used the charging generator should be set lower.

Color and appearance of the plates in glass-jar cells will be quite evident. Plate buckling or fracture, separator wear and sediment can be readily seen. For cells assembled in rubber containers, these features cannot be seen without disturbing and removing the element. To determine the condition of a cell, the element should be removed from the case. Plates wear out gradually, and if either a partial or full discharge is made of the cell the performance is definitely shown.

Specific gravity of the electrolyte is determined with a hydrometer syringe. When high specific gravity electrolyte is drawn into the hydrometer the float inside rides at a high level, during low specific gravity the float sinks.

Purpose and design of a cell determines the specific gravity. For example, glass-jar cells employed in oil-switch control work have a specific gravity of approximately 1.210 when fully charged. In automobile-starting batteries it is 1.280, as is true of those used for propelling industrial trucks and starting diesel locomotives. Higher specific gravity is required in the latter cases because a high discharge rate is needed over a short period of time and is repeated over and over again in normal operation. Furthermore, the size and weight of automotive batteries limit the number and size of plates. As a result, high specific gravity electrolyte is necessary to develop the required power.

Accurate and reliable hydrometers with open scales are necessary for easy reading. Cheap ones are usually inaccurate. Hydrometers should be washed and cleaned regularly.

Cell Voltage

Voltage of any lead cell is slightly more than two volts on open circuit. Discharge or charge voltage depends upon several factors, such as current rate, state of charge or discharge and temperature. Therefore, no general averages for all conditions can be given. In usual six- to eight-hour discharge service, the average cell during discharge is roughly 1.95 v with a final voltage of about 1.75. As soon as the cell is put on charge the voltage rises to about 2.15 and then increases during charge to between 2.4 and 2.7, depending upon local conditions.

In caring for a battery the specific gravity and voltage readings should be recorded and compared with one another from time to time. A marked decrease in any cell reading should be investigated. The amount of water added should be recorded and compared with the maximum allowable.

General maintenance rules for storage batteries can be summarized as follows: (1) add approved water at regular intervals. Distilled water is approved, but local water is usually suitable. Samples are analyzed free by most battery manufacturers and the approval given when found safe. Utilization of local water instead of purchased distilled water effects worth-while savings in many localities, (2) keep the battery case clean and dry, (3) maintain the battery charge, but without excessive overcharging and (4) keep a written record of water additions, voltage and specific gravity readings.

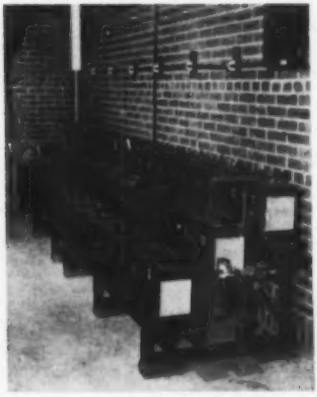
The foregoing maintenance rules should be made more specific for certain applications. For example, control-bus batteries are installed in power and substations to insure an uninterrupted supply of current, for the operation of remote control and automatic protection apparatus, such as oil circuit breakers, field rheostats and valves, as well as for emergency lighting and carrier-current telephony. Most of these batteries consist of 60 cells except for tripping service in small substations where 12- or 24-cell batteries are employed.

Momentary Service

In control-bus service the battery does very little work under normal conditions, usually supplying high momentary current for circuit-breaker operation. The motor-generator set supplies the steady demand, such as power for indicating lights, and gradually restores to the battery any current given out during momentary discharges. Thus, the full capacity of the

Periodic care of mechanical devices, such as bolt connections, is essential

Potential across a 60-cell installation must be read with a good voltmeter



Good housekeeping does not stop at the battery but includes general neatness

battery is available in emergencies. If the battery is discharged in service, the generator should have ample capacity for prompt recharging.

Since a low current is furnished to keep the battery charged, obviously the job must be appropriately engineered and the output adequately controlled in small steps. This charging method is termed "floating."

The Electric Storage Battery Co. recommends that 129 v be maintained across a 60-cell battery or 2.15 v per cell in floating service. An open-scale high-grade voltmeter, that is checked at least twice a year, should be used.

Charging Rate

With the proper terminal voltage the actual current taken by a battery at any time depends on (1) conditions the battery met prior to the time under consideration, (2) temperature and (3) age. These variations are in all cases corrective. That is, the battery takes such current as is necessary to keep it in proper condition. Definite values can be assigned to the proper charging current, which might be read on an ammeter in the battery circuit. Voltage is a much better guide in charging a battery. As a rule, when an ammeter is used at normal temperature, the normal current flowing to a fully charged battery under constant voltage of 2.15 v for an hour or more should be between 0.25 and 1.00 per cent of the eight-hour rate. If the trickle rate is consistently less than 0.25 per cent or more than 1.00 per cent of the eight-hour rate checking the meter is then recommended.

No Line Ammeter

Connecting an ammeter permanently in the battery circuit to indicate the amount of the floating current is not practical as discharge currents would pass through the meter in a reverse direction with possible meter injury.

Some operators do not appreciate the importance of maintaining 2.15 v per cell, and feel that a value close to this figure is sufficient. Temporary voltage variations above and below 2.15 are not harmful if they cancel each other daily. Considering the normal current flowing in a fully charged cell as 100 per cent, Table I shows the variation in current with other cell voltages. A small variation in impressed voltage makes a decided change in floating or charging current. For example, at 2.21 v per cell, twice as much current, 200 per cent, is supplied than at 2.15 v. Continuous operation at other than 2.15 v per cell results in subnormal life. Since the proper floating voltage may not be maintained continuously, a quick check once a month is to raise the impressed voltage for 8 to 24 hr. In control-bus service the auxiliary apparatus usually has a voltage limit of 140, and this increased value is most commonly used for the check.

Therefore, the accurate maintenance of the proper floating voltage is essential if the normally long life built into these batteries is to be obtained. Floating equipment must be accurately adjustable to the proper voltage and operate in a stable manner to closely maintain this value. The use of vernier type controls and a high grade voltmeter—frequently calibrated and with sufficient scale length to permit accurate reading—are of value in accomplishing close voltage regulation.

Equalized Charge

In addition to floating, the unit must be capable of charging at a rate that will bring the battery back to a state of full charge within a reasonable time after an emergency discharge. Consideration should be given to any contemplated future increase in the steady load. Charging equipment must give equalizing charges, as called for in instructions. Current available for this charging (exclusive of that current required for steady load) must be not

TABLE 1—FLOATING CURRENT ACROSS FULLY CHARGED CELL, 1.210 SP GR, 70 F

Floating current (per cent)	Impressed volts	
	Per cell	60 cells
75	2.13	127.8
100	2.15	129.0
150	2.18	130.8
200	2.21	132.6

TABLE 2—MAXIMUM WATER REQUIREMENTS, FLOATING SERVICE, 1.210 SP GR, 70 F

Cell plates	Capacity-8 hr, Amp-hr	Pints per month 60 cells
9	160	9
11	200	11
17	320	18
27	520	29

less than 1/8 of the 8-hr discharge rate. Higher charging rates are desirable, of course, but seldom considered necessary to allow for more than 50 per cent of the 8-hr discharge rate in amperes.

Charging of a 60-cell battery may be completed without exceeding the control bus voltage limit of 140 v. This limitation does not appreciably affect the available capacity, since, in most cases, the battery is 90 per cent charged, or more, when the voltage reaches the maximum of 140 v.

As a check on overcharge, in addition to the voltmeter calibration for accuracy, careful readings should be kept of the amount of water added from time to time. With sealed cells in floating service water is usually added only three or four times a year.

Typical maximum limits for water per month are shown in Table 2. If these quantities should be exceeded unnecessary and harmful overcharging is definitely indicated.

Water Level

Approved water should be added to all storage batteries before the plates or separators are exposed to air. Glass-jar cells carry a mark to which the water level should be maintained. Automatic filling devices are available, but the filling is usually so infrequent that most operators employ a simple syringe. Others use a large jar or bucket located above the battery. To the former is attached a small hose, which is pinched to stop the flow of water.

When transporting or storing battery water metallic vessels (unless made of lead) must not be used. Glass, earthenware or rubber receptacles or wooden kegs not utilized for any other purpose are recommended, provided they are kept clean and covered.

Never add special solutions, powders or jellies. Many are injurious and have a corrosive action on the plates. This reduces the cell voltage and capacity.

Record All Data

Specific gravity of the electrolyte and cell voltage are important data to record. When taking readings for record, the relative state of charge should be the same. On a floated battery, the voltage readings should be taken 10 to 15 min. after starting the monthly equalizing charge, and the gravity readings 10 to 15 min. after the charge is completed to avoid gassing.

If the individual cell voltages, read to the hundredth of a volt, are recorded each month, three or four times a year will be sufficient for a check of cell gravities. If this procedure is not followed the cell gravities should be recorded monthly. Readings should be reviewed and plotted for comparison with previous data to detect any irregularities.

Keeping the outside of the battery clean and dry does not seem an unusual rule, but sometimes in dirty and dusty locations this small job will be the most maintenance work required. Over a period of months the covers may become damp from atmospheric condensation or electrolyte spillage. In this event, the jars and covers should be wiped with a rag moistened with a solution of ammonia to neutralize any acid. If not neutralized, or completely removed with a dry cloth, the acid might remain indefinitely, and since it will not evaporate moisture will be absorbed from the air and surfaces will remain damp.

Dirt or dust, which accumulates on dry covers, is readily wiped off. Once a year the bolt connectors should be checked for tightness and corrosion.

Vent plugs should be in place at all times except to add water or to take hydrometer readings.

Sealed glass-jar cells employ a vent plug equipped with a condensing chamber, which effectively traps all acid spray that drains back into the cell while letting gas escape through vent openings. Thus only oxygen and hydrogen are permitted to escape from the battery. Consequently these cells need not be installed in separate rooms to prevent corrosion of exposed metal work on adjacent equipment.

Hydrometer Readings

In taking hydrometer readings, consideration must be given to several important points. They should not be taken immediately after adding water because the water must be given about a day to mix with the electrolyte in floating service.

Level of electrolyte in relation to the mark on the jar should be noted. During discharge the level falls slowly because water, and water only, is decomposed chemically.

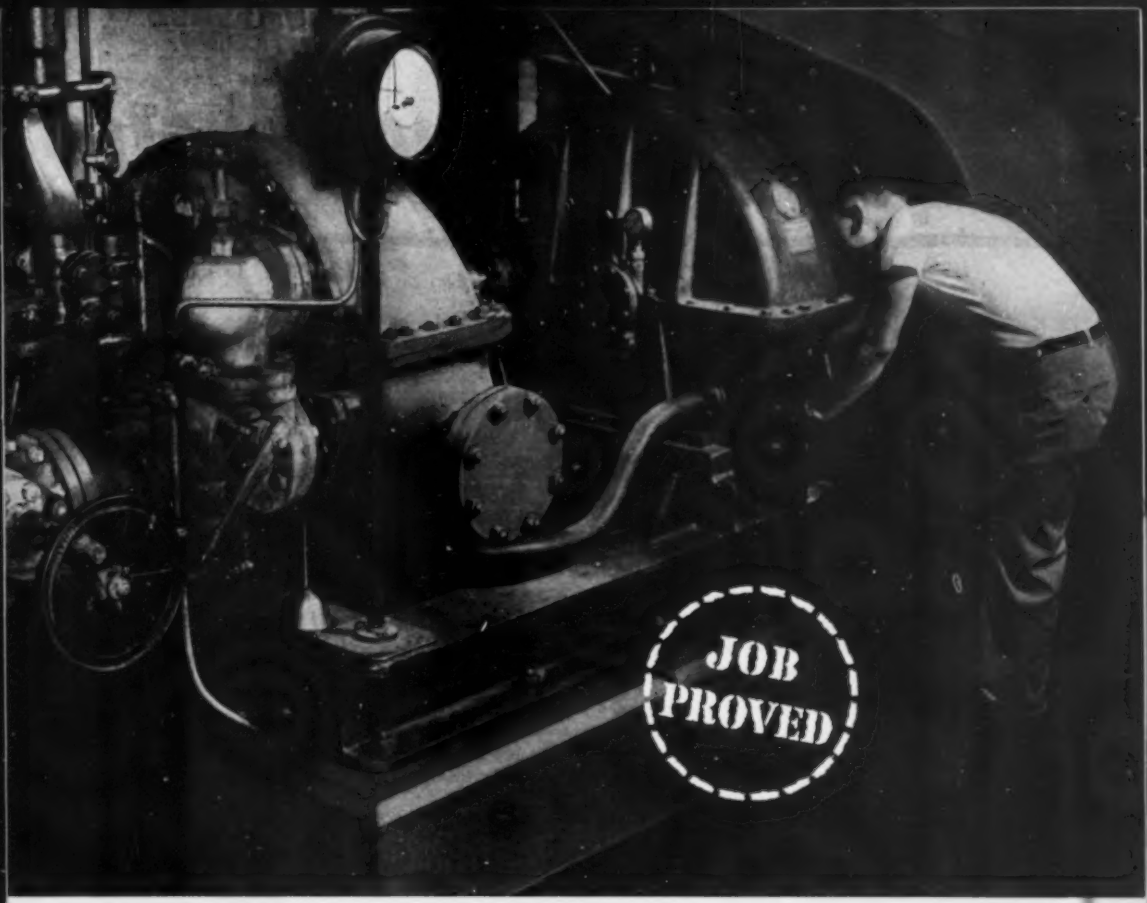
Temperature also affects the specific gravity, but most control-bus batteries are located in rooms of relatively unchanging temperatures. Therefore, the effect is not as great as with outdoor batteries. A variation of 30 F changes the specific gravity 10 points. For example, suppose normal temperature (zero correction) is 70 F, if the electrolyte temperature is 100 F, 10 points should be added to the hydrometer reading for comparison with the 70 F reading. In the case of 40 F electrolyte temperature, 10 points must be subtracted from the hydrometer readings for comparison with the 70 F reading.

The Cover Illustration — LP Gas in the Heat-Treatment Field

● This picture was taken at the Sunnyside Metal Products Co., Sunnyside, New York, and the plates were made available through the courtesy of the Union Carbide and Carbon Co., Electro Metallurgical Div. LP Gas as a standby fuel during periods when natural gas is curtailed is used to fire these furnaces. Heat-treating with LP gas is described in the feature story starting on page 65 of this issue.

Developments in the equipment field have played an important role in the rapid expansion within the past few years, and LP gas is becoming a must in the industrial heat-treatment of metals. Parts treated may be medium or high carbon steels, or they may be gears or other parts that have been previously carburized and cooled slowly. Formerly it was expected that such parts would lose some carbon from the surface during reheating, and allowances were made for grinding subsequent to hardening in order to remove the softer, outer layer and expose the fully hardened metal.

With the increasing demands for better and more durable products of metal, a gradual trend has developed toward separating the work from the products of combustion to prevent surface reaction on the articles being heated. Also, heating for various processes at high temperatures contributed to rapid decarburizing, scaling and oxidation of metal surfaces. For medium or high carbon parts subjected to considerable stress, loss of carbon and surface scaling are serious problems.



SUNVIS 900 OILS REDUCE COSTS 25%

Papermaker Gets Maximum Equipment Protection, Extra Long Service, from Superior Turbine Lubricants

In a large paper mill, eight steam turbines drive paper machines and pumps, and generate power for ventilating equipment. Ten years ago the mill began lubricating these turbines with a "Job Proved" Sun oil. They gave unfailing service with remarkably low oil and maintenance costs.

Four years ago, when Sunvis "900" Oils first became available, the Sun representative serving the mill saw an opportunity to effect even greater economy. He suggested that the medium-priced Sun oils in use be replaced by the more costly Sunvis "900" Oils. He knew that these modern, fortified lubricants—*more costly* on a per-gallon basis—would prove *less costly* through the years because of their remarkably long life. His suggestion was followed.

The Sunvis "900" Oils have fully justified this confidence, saving the mill 25% or more on lubrication costs. Furthermore, the papermaker knows his equipment—running or idle—is fully protected from rust and corrosion.

Sunvis "900" Oils are *good for the life of your production equipment.* Coupled with the know-how of the Sun representative who calls on you, they are good for your pocketbook, too. For more information, send for a copy of the illustrated booklet "Sunvis '900' Oils." Write Department IP-8.

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SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

SUNOCO®

It Gives You the Torque

Edward Valve IMPACTOR HANDWHEELS

GIVE YOU FROM 2.8 TO OVER 12 TIMES THE FORCE OF AN ORDINARY HANDWHEEL TO CLOSE VALVES

It takes three strong men, pulling their hardest, on an ordinary valve handwheel to equal the closing force of ONE man using an Edward 16" Impactor Handwheel. With progressively larger size Edward Impactor Handwheels, the force available to close a valve is equal to six, eight, ten and, yes, *even twelve men.*

Originated and patented by Edward and improved through the years, the Impactor handwheel is the one most effective means of manually closing a valve so it is absolutely tight against high operating or test pressures in power, petroleum, chemical, marine, or industrial plants. It needs no clumsy expensive gear or toggle construction, or the use of extension levers or cinch bars for actuating.

Its space-saving design allows piping designers great latitude in locating valves, walkways and operating platforms.

But most important, the Edward Impactor handwheel means sure, fast operation of valves—big or little—in an emergency or under normal operating conditions by a single man. It saves manpower by giving ONE man more power. NOW standard equipment on most 900, 1500 and 2500 lb Edward Valves, 2½ inches and up.

The Impactor principle is simple. Two heavy lugs are cast on the underside of the wheel: a sharp turn of the wheel causes these lugs to strike simultaneous blows against a steel cross arm, locked to the stem or revolving EVaithrust yoke bushing. Write for full facts, Edward Valves, Inc. 40 West 144th Street, East Chicago, Indiana.

WOMANPOWER BEATS MANPOWER!

Many smaller size Edward valves are available with the new Impactor Handle (right in photo) for greatest closing efficiency. Design principle is same as Impactor handwheel, and test gages prove it too gives you the torque of six hands or 2.8 times the closing force of an ordinary handwheel. You know the valve is closed absolutely tight with an *Edward* Impactor Handle.

FEATURES LIKE THIS SAVE YOU MONEY AND WORK....

That's why it pays to specify Edward Valves.

# of SIX Hands and More

ORIGINATED BY EDWARD
"BIRTHPLACE OF BETTER
VALVE DESIGNS"

Another Product

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

USES FOR A SKIP HOIST

WILBUR G. HUDSON, *Consulting Engineer*

WHERE THE PROBLEM is to lift bulk material along a vertical or nearly vertical path, the choice usually lies between a skip hoist and bucket elevator. Either does a good job. The higher the lift, the better the skip shapes up in first cost. If the path is inclined, the skip is best as it eliminates the many chain rollers running on guides. The skip is advisable when the material contains many large, heavy lumps or is actively abrasive or corrosive in action.

For a moderate lift, the elevator often is preferred as costing less. The hoisting unit of a skip is costly. However, for short lifts with small capacities, as when handling ashes from a small boiler room, a simplified, semi-automatic skip, Fig. 1, will cost about a third as much as the standard skip with enclosed geared hoist. Another alternative, where the layout permits, is an inclined belt conveyer. This, with its bridge, costs more, but for the largest capacities is preferable for most applications.

Finally, for moderate lifts and capacities, for flowable, non-injurious materials, the continuous-flow elevator should be considered as costing substantially less than a bucket elevator or belt conveyer, and perhaps slightly less than a skip, though the latter will show a lower maintenance cost. The parts of the skip subject to wear are the cables and automatic loader mechanism, so the shorter the cycle the higher the maintenance cost.

Type of Path

Typical paths are shown in Fig. 2. The straight inclined path, (A), where applicable, has the advantage that fewest bendings of the cable are required. Path (B) often fits in best where discharge is closely off the loading point. Path (C) provides a discharge point directly over the loading point, with discharge on the same side as loading. Path (D) permits discharge at a point further off the loading point than (B).

There is a very wide difference in performance and power requirements in the several types of skips. Consider a lift of 100 ft and 60 cu ft buckets, with coal of 50 lb per cu ft and automatic loading. Each of the skips analyzed below calls for the same size hoisting machine, but the capacities and horsepower vary widely:

1. Medium speed (140 ft per min), capacity, 50 tph, uncounterweighted — 39 hp, counterweighted — 12 hp.
2. High speed (260 ft per min), capacity, 75 tph, uncounterweighted — 73 hp, counterweighted — 22 hp.
3. Balanced buckets (260 ft per min), capacity, 150 tph — 44 hp.

Note the power reduction with counterweights, which is made equal to the weight of buckets plus half the load. If the lift is 200 instead of 100 ft, the hp does not change, but the

Fig. 1—Semi-automatic skip costs about a third as much as standard unit does

Fig. 2—Here are typical paths for a skip hoist showing how the unloading point can be arranged off the vertical to one side or the other from a straight incline

capacities are respectively, 27, 45, and 90 tph instead of those given before.

Making a different analysis, determine the size of bucket and horsepower for a capacity of 100 tph and a 100 ft lift:

1. The medium-speed skip requires a 120 cu ft bucket, and 72 hp if uncounterweighted, or 24 hp if counterweighted.

2. The high-speed skip requires an 80 cu ft bucket, and 93 hp if uncounterweighted, or 29 hp if counterweighted.

3. The balance skip requires 40 cu ft buckets, and the hp is 29.

The first is undesirable because of the extremely large bucket, a more costly structure, and a larger hoisting machine. If the skip run is inclined, the hp for a stated speed and bucket size is reduced sharply as shown in Fig. 3. For flat inclines, part of the load spills out and some other type of conveyer may be better.

Sample Application

Consider a specific problem of handling 70 tph of calcined gypsum weighing 60 lb per cu ft, from cars to a storage bin 50 ft long and 100 ft high, parallel with the track.

We might consider an L-path continuous-flow elevator with overhead distributing screw conveyer. The elevator duct will have a cross-section of 136 sq. in. and the speed will be 55 fpm. The chain pull will be 20,000 lb., which is very high. We require 40 hp for the elevator and 15 hp for a 20 in. screw conveyer.

Another possibility is a gravity-discharge bucket elevator of 120 ft vertical, and 50 ft horizontal centers. Buckets will be 20 x 20 in. spaced 18 in. centers. The elevator requires a 15 hp motor, and a vibrating feeder of 1 hp.

Finally, we can do the job with a fully-automatic skip, counterweighted, with 80 cu ft bucket, speed 140 fpm, and 20 hp hoist, discharging to a screw conveyer with 15 hp motor. We might extend the skip some 20 ft higher and eliminate the screw.

Cost Comparison

The first selection will cost least and require the greatest horsepower. Its maintenance will be highest. The second will be highest in first cost. The skip will be somewhere between the two in first cost, but its maintenance will be lowest.

If the lift requirement is greatest, the continuous-flow machine passes out, the bucket elevator is handicapped because of mounting first cost, and the skip remains in the picture for any height increase. On the other hand, if

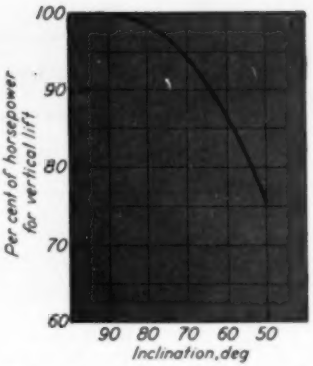


Fig. 3—Power required to drive skip falls as path inclines from vertical

the lift is short, the continuous-flow machine figures advantageously as costing far less than the bucket elevator, and the skip fades out because the shortened cycle builds up a high cost of cable and feeder parts maintenance on the equipment.

There are conditions where the skip fulfills the requirements better than any other machine, Fig. 4. At a midwest steam plant, it was required to lift coal from track hopper to a Bradford breaker in the middle structure, and from the breaker up to the bunker. A balanced skip was installed, one bucket handling the coal to the breaker, a lift of 55 ft, the other bucket elevating coal from the breaker, a lift of 128 ft. The single-drum hoist was stepped down in diameter to give bucket speeds of 69 and 160 fpm. The buckets were 60 cu ft and the capacity of each lift was 40 tph. One skip did the job for which two had been contemplated.

Analyzing the operation and disregarding the slowdown at each end of the run, we see that the up-trip of the lower bucket at 69 fpm requires 48 sec. In 48 sec the upper bucket at 160 fpm rises 128 ft as required. Actually the motor was a two-speed machine for automatic slowdown to 80 fpm at the ends of travel of the high-speed bucket. This made a terminal slowdown from 69 to 35 fpm in the lower skip, but did not affect the overall time of the cycle.

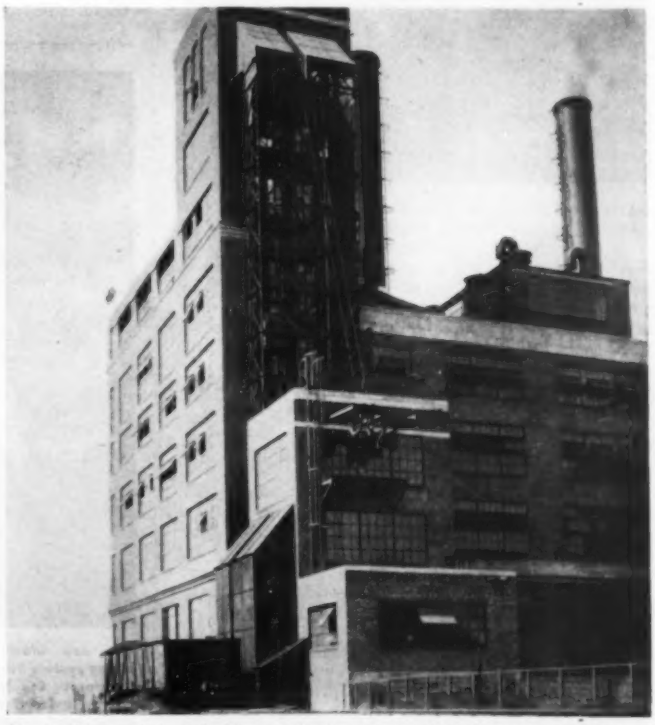


Fig. 4—Using a balanced skip, one bucket lifts coal 55 ft to the breaker and the other elevates coal 128 ft from breaker to storage with stepped-drum hoist

Spot News

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Radiant Heating Uses Plastic Tubing In Floor

Plastic tubing has been used with excellent results for a radiant panel floor heating system in a new industrial plant of the Pump, Pipe and Power Co., Portland, Oregon. ¾ in. Carlon plastic tubing was used in new building construction and in converting existing buildings to radiant heating. Plastic tubing was chosen because of its resistance to

rot, rust and electrolytic corrosion; ease of installation; low frictional loss and the long lengths in which it is available.

In new buildings, the tubing was first laid on rough flooring and held in position with hooks while return bends were made. Wire mesh was then placed over tubing and mesh and tubing were tied together at 2 ft intervals with binder twine. Hooks were removed after tubing was secured, and entire system was filled with water to eliminate air in the line. Pressure was maintained on system to prevent collapse of plastic tubing while 2 ½ in. of concrete were poured.

Nations Critical Need For Scrap Emphasized At Conference

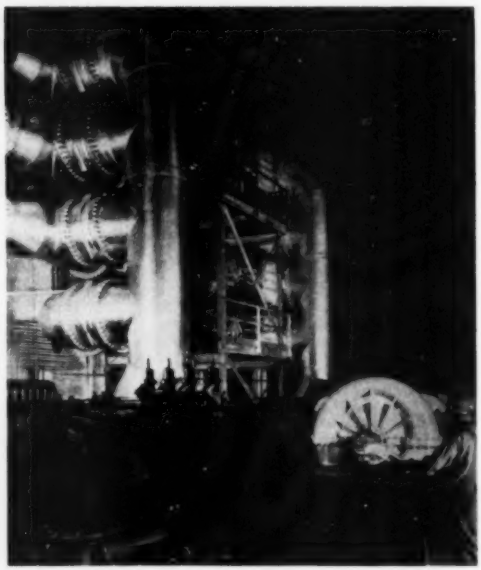
Inventories of scrap iron and steel at the nation's 200 mills and foundries are dangerously low. Unless scrap supplies are appreciably expanded within the next four months the steel production program faces a serious threat of being crippled, and emergency conference on scrap recovery, attended by industrial and Federal government officials, was advised.

NPA reported that two large producers recently were operating with less than a two day supply of scrap and that most other mills have less than a two week supply, compared with a normal 60 day or larger inventory. Although there have been no shutdowns yet, any disruption of the present flow of scrap would have crippling effects.

The present consumption of scrap steel is the highest in history—higher even than during the peak years of World War II. The highest war-time consumption was 24,500,000 ton of scrap steel a year. Last year, 29,500,000 ton were used. This year the consumption is expected to rise to 32,500,000 ton or more—an increase over 1950 of at least 3,000,000 ton.

The conference was held chiefly to review the publicity and advertising programs for scrap recovery being activated by government and industry. Among these was the multi-million dollar program of the Advertising Council, Inc. This includes widespread circulation of the need for information on scrap through national advertising. It is aimed at all possible sources of scrap steel and will involve the cooperation of industry, trade associations and trade magazines.

NPA explained that the scrap program is on an industry level because the greatest need is for the heavier grades of dormant industrial scrap. The lighter grades, which would come from households are not required at this time.



Two new blast furnace turboblowers and an intricate piping system have been installed by Dravo Corp. Machinery Division at the Jones & Laughlin Steel Corp. Eliza Furnaces. These De Laval machines each supply 100,000 cfm of air under inlet conditions and are designed for 410 psi steam pressure at 700F. The turbo blowers and piping seen in the background were installed without disrupting operations

A truckload can mean 4,000,000 Btu capacity. Each of the Thermobloc unit heaters, (laid crosswise on the truck body), is capable of producing 1,000,000 Btu per hr output. Prat-Daniel Corp. made them for Valley Steel Products Co.

Production Of Raw Materials Will Take Most Conveyer Belting

Nearly 40 per cent of the conveyer belting being made in the new B. F. Goodrich Co. $5,000,000 industrial belting plant will be delivered to coal, iron ore and other mines. The remainder will go to major processing industries, public utilities and construction projects. Since the first conveyer belts were introduced in underground mines in 1929, over 1,000 miles have been installed in American mines.

Despite the greater production made possible by the opening of the new plant, B. F. Goodrich now has a 500,000 ft backlog of conveyer belting orders. One of the rubber company's newest belts was installed last month at the B & O's new ore dock at Curtis Bay, Maryland. It can move 2,000 ton of iron ore an hour.

Aluminum Pipeline Shows No Corrosion After One and One-Half Years Service

Recent uncovering of the 4 ft bare aluminum bypass installed approximately seventeen months ago in the Alabama-Tennessee Natural Gas Company's 8 in. aluminum pipeline revealed no discoloration or corrosion of any sort. This section of pipe was installed with special bypass valves so that it could be dug up at intervals without disturbing the operation of the main pipeline serving Reynolds Listerhill, Ala., plant.

Careful inspection both inside and outside was made to determine any sign of wear or corrosion. No discoloration or corrosion of any sort could be found on the outside, where the bare pipe was in contact with the soil; nor on the inside, which carried natural gas.

The test was supervised by the officials of the Alabama-Tennessee Natural Gas Co. and representatives of Reynolds Metals Co. who supplied the pipe. Based on this inspection, all concerned agreed that this pipe would last indefinitely under such conditions.

Sun Oil's New "Arosorb" Process Will Be Available to Industry By License

More benzene for the production of synthetic rubber, plastics, resins, "soapless soaps" and chemicals for the military will result from a new manufacturing process developed by Sun Oil Co.

Called the "Arosorb" process, the new development will be incorporated in an $8 million plant soon to be built at

(Continued on page 118)

this WEINMAN pump is ENGINEERED NOT to clog

Plants that have to handle liquids carrying solids, foreign material and stringy trash get best results from WEINMAN Centrifugal Non-Clog pumps.

These WEINMAN pumps are best for this job because they are created to meet your specific requirements. This WEINMAN non-clog "know how" dates back a good many years. It's the cumulative experience of Centrifugal Specialists who concentrate on only ONE product—PUMPS.

Feel free to tap this experience whenever you have a pumping problem—non-clog or otherwise. The WEINMAN man is ready whenever you are. Just write, wire or phone.

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Improving a Proven Principle

SUPERIOR'S INDUCED DRAFT

Built to operate on the same proven principle as natural draft, Superior's *Induced Draft*, because of its built-in design, low-speed fans, and unique construction, assures maximum boiler capacity at high efficiency. It provides accurate control of draft conditions without the usual disadvantages of mechanical draft. Cleaner, quieter, and safer in every respect, it represents but one of the many "Designed by Demand" features which contribute to the overall efficiency and long life of Superior Steam Generators.

Superior Steam Generators are shipped completely assembled, backed by undivided responsibility • Burn gas or oil, or both • 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water • Write today for Catalog 302.

1. Tailored to the demands of the boiler, and built-in, Superior's *Induced Draft* regulates the air necessary for efficient combustion. Leaves front platform clear.
2. Full-width fan construction minimizes the danger of overworked or burnt-out tubes by providing an even draw across the entire tube area of the boiler.
3. *Induced Draft* eliminates the danger of forcing the products of combustion into the boiler room to spread dust, dirt, and unhealthful air throughout the building.
4. Especially-designed over-size fans run slower, minimizing wear and maintenance.
5. Quieter, low-speed fans eliminate the high-pitched whine commonly associated with forced mechanical draft.
6. Long-lived trouble-free operation assured by corrosion-resistant fans with outboard mounted bearings located out of the path of combustion gases.
7. Eliminates the expense of a large chimney.

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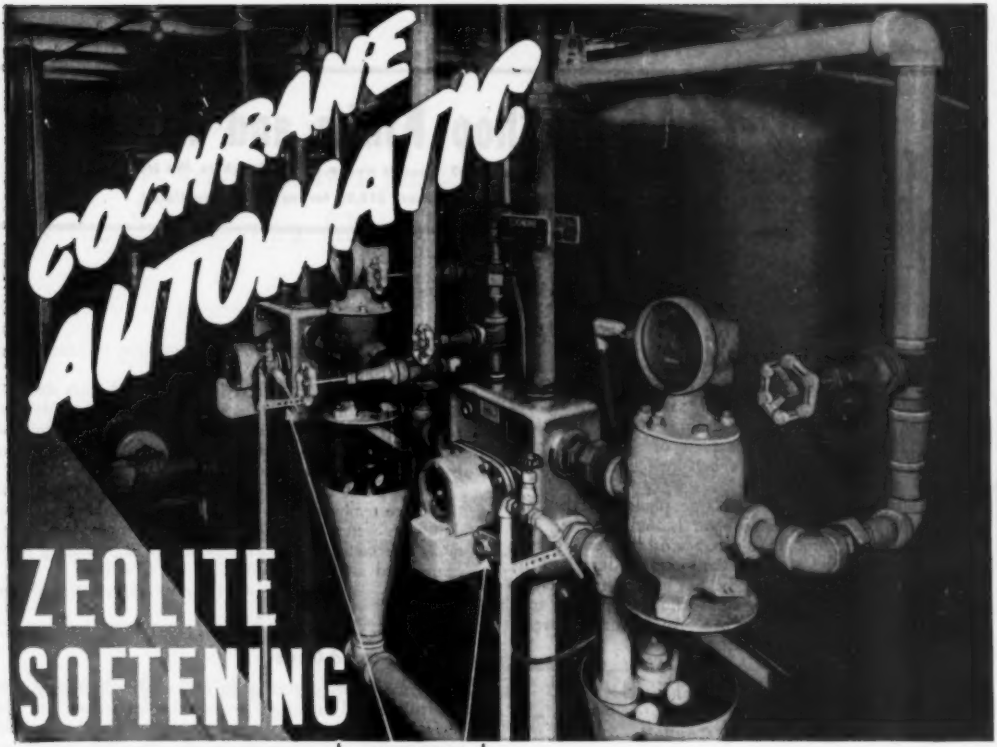

COCHRANE HYDROMATIC SINGLE CONTROL VALVES

AUTOMATIC Water Softening is a great saver of time, labor and money. Cochrane Automatic Zeolite Softeners are the latest type of softener, equipped with the Cochrane Hydromatic Single Control Valve, a remarkable and exclusive development in control valves, being six individual valves in one. It is non-leaking, non-scoring, and easily operated (in the manually operated softener, a change from one position to the next is accomplished with a touch of the finger . . . in the automatic softener, a tiny 40-watt motor is sufficient to actuate the valve). No concrete sumps are required for backwash or rinse rate control. There is no hydraulic shock to the exchanger bed. Maintenance of the valve is simple and easy.

You can get the last word on modern zeolite softening from Cochrane Corporation, pioneers and leaders in industrial water softening, by writing for a copy of a recently published bulletin, Publication 4520, on Cochrane Zeolite Softeners. Much new information on zeolites, both natural and synthetic, is contained in this bulletin, together with other valuable data on water softening. The coupon is for your convenience.

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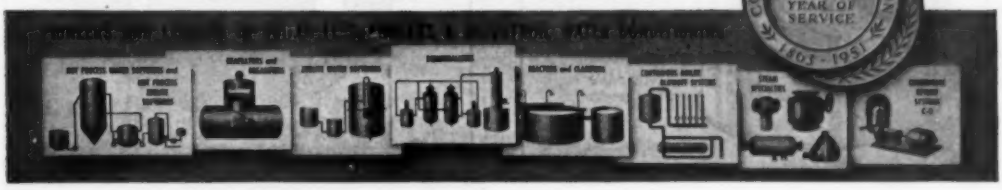

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What's your idea? Send it and a rough sketch to the How-to Editor.
We pay at least $10.00 for each item published.

Fluorescent Tube Destroyer

Pictured in the cut-away sketch below is a very handy and easily constructed outfit for safely destroying old fluorescent tubes. A 55-gal drum serves as the tank. Two lengths of conduit and a piece of sheet steel make up the feeding device, and a half-inch steel rod serves as the destroyer.

The tubes are fed into the large pipe until they are against the steel plate. The plate is under water. The steel rod is then brought down against the end of the tube, breaking it and allowing the pieces to drop into the water. The vacuum in the tube has a sucking action at the moment of breaking. This action keeps the tube well down against the breaker rod. Approximately twelve tubes per minute can be safely destroyed.

—Charles W. Shutt, Alma, Mich.

Removing Stuck Wires from Conduit

The power and control wires to one of our drip-well pumps became short circuited within the 80-ft long conduit, which was embedded in the concrete basement floor. Deteriorated insulation caused the wires to stick to the inside of the conduit. Repeated attempts to pull the wires from both ends of the conduit, which extended slightly above the floor line, caused the wires to break off until there were only about two inches of wire protruding beyond the conduit.

The insulation was softened and loosened from the conduit by pouring a mixture of carbon tetrachloride and light oil into the conduit and letting it stand overnight. The wires were removed with little effort the next day by grasping the short ends with a pair of pliers.

The solvent mixture and remaining pieces of insulation were removed from the conduit by flushing the conduit with water from a hose connected to the city water tap. The conduit was then dried out by blowing with compressed air before pulling in the new wire.

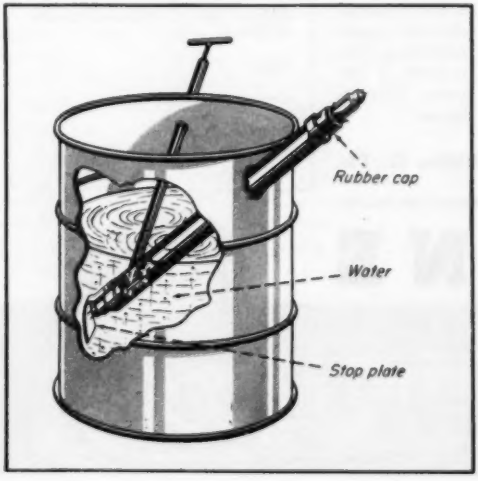
—Carl Tretinyak, Austin, Minn.

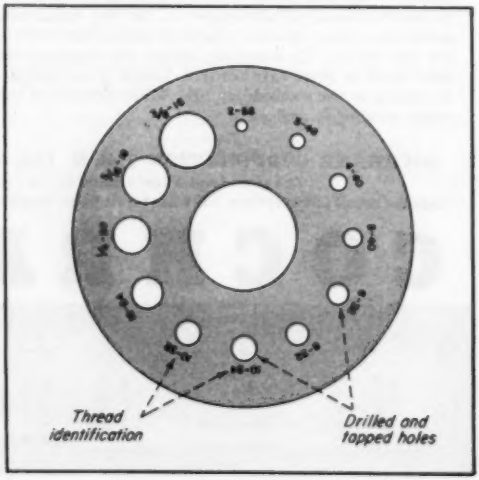
Screw Thread Gage

A handy screw-thread gage may readily be constructed by drilling and tapping a series of holes around the flat surface of a fairly large brass or steel washer, each hole being tapped a different thread diameter and number of threads per inch.

The thread identification should be etched or stamped alongside each hole. A brass washer is easier to thread, but the threads are not as strong as those tapped in a steel washer. The hole in the washer permits the gage to be handled and hung up easily.

—Thomas Trail, Catonsville, Md.





For thousands of years
Orientals have known ramie
as the long-lasting fibre . . .

Now . . . Johns-Manville
makes ramie fibre into
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That's why *NAVALON* cuts packing costs to the bone . . .

IF YOU NEED A PACKING for reciprocating service that can take punishment and *last* . . . against fresh or salt water, brine, cold oil, and other cold liquids . . . try Navalon.

Navalon's long-lasting properties are inherited directly from ramie—a fibre that has been known for thousands of years for its strength and its rot-resisting qualities.

Because these long-lasting qualities of ramie—its high tensile strength and its rot-resistance—have been retained in Navalon, and because of a special Johns-Manville process that imparts unique lubricating properties, Navalon is consistently out-performing other packings in cold liquid service. In plant after plant, Navalon is standing up where other packings fail . . . reducing down time . . . and cutting packing costs to the bone!

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NEWS . . . of men and companies

HONORS

The Babcock & Wilcox Co.—Albert Iddles, president, was given the honorary degree of Doctor of Engineering by Polytechnic Institute of Brooklyn for "outstanding services to industry and the engineering profession."

The Cooper-Bessemer Corp.—The 1951 Lamme medal, one of Ohio State University's highest honors, was awarded Ralph L. Boyer, v-p and chief engineer for "development of today's important gas-diesel engine and the high compression spark-ignited gas engine."

SOCIETIES

American Society of Heating & Ventilating Engineers—George Akers of the George W. Akers company was elected president of the Michigan Chapter for the 1951-52 season.

The American Society of Mechanical Engineers—R. J. S. Pigott, director of the engineering div. of Gulf Research & Development Co., was nominated as 1952 president.

Greater Philadelphia Plant Engineers Club—J. R. Clemens, plant engineer of Link-Belt Co. was elected president succeeding David J. Godschall of the Heintz Manufacturing Co. who becomes a member of the board of governors.

Alloy Casting Institute—Election of W. F. Wilson, general sales manager, Lebanon Steel Foundry, as president of the Alloy Casting Institute was announced. Other officers are H. T. Harrison, v-p of The Duraloy Company, v-p; and E. A. Schoefer, who was re-elected as secretary and treasurer.

ANNIVERSARIES

Alan Wood Steel Co.—Celebrated in July its 125th anniversary.

Taylor Instrument Co.—Lewis B Swift, president, announced the company's 100th anniversary in the centennial issue of Taylor Technology.

SALES OFFICES

American Air Filter Co.—A new office building has been recently completed. It was designed and built by the Austin Company with Ronald and Associates the heating and air conditioning engineers.

The Babcock & Wilcox Co.—Leasing of five entire floors in the new 32-story Chrysler Building East, New York, was announced by Alfred Iddles, president, and Walter P. Chrysler, Jr., president of the building corporation.

General Controls Co.—Five new factory branch offices will be opened at Salt Lake City, El Paso, Omaha, Milwaukee, and New Orleans.

The Kuljian Corp.—The Washington offices have moved to 1832 K. Street NW.

Leeds & Northrup Co.—The Houston office has been moved to 2480 Times Boulevard. It will serve the area from New Orleans to the California line.

Quaker Rubber Corporation—The Detroit industrial area will be served by a new stock-carrying branch warehouse and sales office at 872 W. Milwaukee Avenue.

Worthington Pump and Machinery Corporation—Sales and engineering functions of the Water Treating section were moved from the Dunellen, N. J. plant to the Harrison, N. J. plant.

NEW REPRESENTATIVES

Bigelow-Liptak Corp.—Otto van Perbandt will represent the company in Southern Ohio, part of Indiana and all of Kentucky. He will work out of 305 Schwartz Building, 906 Main St., Cincinnati.

Chelsea Fan & Blower Co.—The appointment of H. R. Onarecker and Company of 2518 Times Blvd., Houston, Texas, as the representative for the State of Texas was announced.

Conoflow Corp.—Harold G. Jones Co., 502 Empire Building, Pittsburgh, is the representative in that area.

Representative for the Houston area is M. N. Aitken Co., 5960 Kansas Street.

The Hilliard Corp.—Guy T. Martin & Company, 642 East Olive St., Gardena, Calif. is the representative in that state.

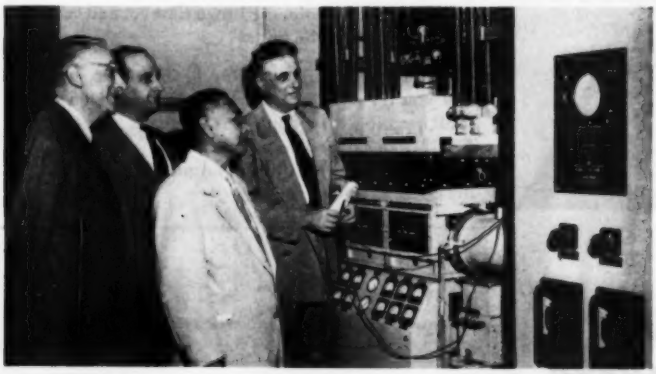
The Wheelco Instruments Co.—New district agency for the State of West Virginia was opened by Engineering Products Co., Charleston.

Worthington Pump and Machinery Corp.—Oficina Tecnica Armando Capriles C. A. (Otacca), Santa Caprilla e Migares 21-1, Apartado Postal 265, Caracas, Venezuela, announces a recently signed distributorship agreement to handle the air conditioning and refrigeration line.

EXPANSIONS

The Airetool Mfg. Co—The Ajax Expander Company has been acquired recently. Manufacturing facilities and inventory of Ajax has been moved to the Springfield plant where Airetool will continue to produce and stock the

(Continued on page 98)



H. G. Noordberg, v-p, and B. D. VanEyck, ind. eq. mgr., Philips Export Corp., sellers of equipment; D. Tiosejo, v-p of Superior Gas and Equipment Co. and Otto Jessen, mgr. of I-T-E Rectifier Div. view the contact mechanism, the heart of the mechanical rectifier which will help supply chlorine in the Philippine Islands

The international aspect of the basic engineering problems for plant services were emphasized in a meeting at the I-T-E Circuit Breaker Co. when engineers of a number of American companies gathered to witness tests on a mechanical rectifier installation for the Superior Gas and Equipment Co. of Manilla, Philippine Islands.

D. Tiosejo, v-p of the Philippine company, and M. I. Felizardo, chief engineer and director, previously visiting the United States to choose a rectifier which would provide uninterrupted source of d-c power to operate a new chlorine plant, were present at the acceptance tests. Deciding factors in Superior's selection of equipment were the rectifier's high efficiency (96.6 per cent), small space requirement, low maintenance cost and ease of operation.

Power from the $700,000 plant will produce an estimated six tons of chlorine and caustic soda daily for water chlorination, bleaching and civil defense purposes. The mechanical rectifier installation has a rating of 12,000 amp and will deliver 65 v d-c. Primary voltage is 13,200 v, 3 ph, 60 c.

KIRK & BLUM FUME CONTROL SYSTEM

60% More Air Less H.P. Lower Cost

at Estate Heatrola Div.,
Noma Electric Corp.
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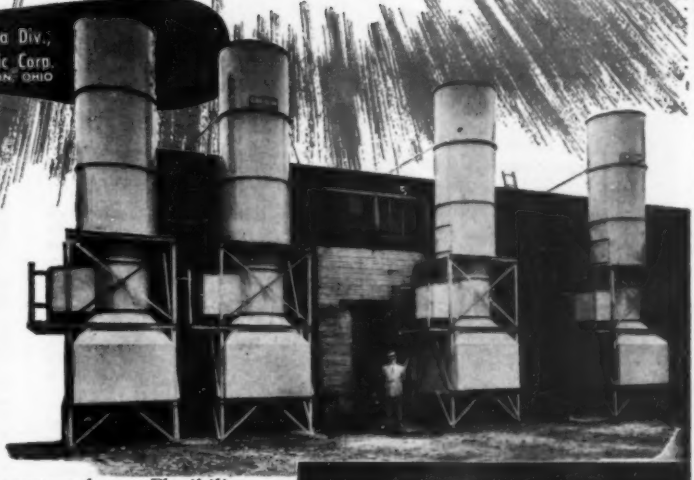

• Although a conventional duct system would have required as much as 100 H. P., this KIRK & BLUM *ductless* Fume Removal System uses just 40 H. P. to handle 160,000 cubic feet of air per minute . . . doing an excellent job of fume removal at lower initial cost and lower operating cost.

In the plant of this noted stove manufacturer, a battery of ten 8-foot tanks are ventilated by the fume exhaust system shown. Flexibility of capacity is obtained by operation of one or more fans as production requires. Even when baskets containing the parts are lifted from the tanks, the system easily removes all steam and fumes.

Completely designed, fabricated and installed by KIRK & BLUM, this Fume Control System is another example of engineering skill and experience combined to save money for a long list of America's leading plants. For a comprehensive picture of KIRK & BLUM Fume Control Systems, write today for Booklet, "Dust Collecting Systems for Metal Industries".

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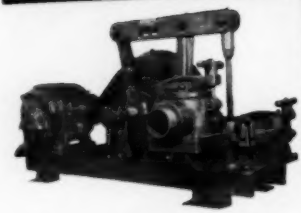
FUME CONTROL SYSTEMS

In plant after plant it's

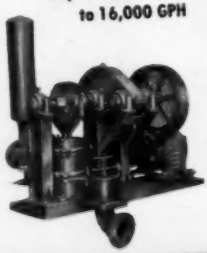
MARLOW PUMPS PREFERRED

for handling difficult industrial wastes



There are more Marlow sludge pumps and more Marlow diaphragm pumps in service handling waste materials than all other makes combined.

Capacities from 1,000 to 16,000 GPH



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MARLOW PUMPS

515 GREENWOOD AVENUE

RIDGEWOOD, NEW JERSEY

Leading manufacturer of Self-Priming Centrifugal and Sludge Pumps

EXPANSIONS

(Continued from page 96)

Ajax "Collins Type" and "C.B.," "P. R." and Linsen series of tube expanders.

Crane Packing Co.—Construction of new general offices and plant facilities is underway. The new plant site, situated on Oakton Avenue near Lehigh in Morton Grove, Illinois, will cover 133,000 sq ft when completed.

Fairbanks, Morse & Co.—Construction of a new plant near Kansas City, Mo. will be started by the Stone & Webster Engineering Corp. It will have 500,000 sq ft of floor space, which includes a foundry, and is to be used to make engines and pumps.

The Glidden Co.—$700,000 will be spent immediately for expansion. The new plant facilities will be an addition to the Soya Products Div. plant in Chicago.

Monsanto Chemical Co.—Contracts for the design and construction of a multi-million dollar elemental phosphorous plant have been awarded to the H. K. Ferguson Co. and the Morrison-Knudsen Co.

Nox-Rust Chemical Corp.—Construction of a new plant at 47th and Central Avenue, Chicago has started, it was announced.

Pressed Steel Car Co.—Announcement has been made that the Chicago Steel Tank Co. has been acquired.

Quaker Rubber Corp.—Quarter million dollar expansion of hose manufacturing facilities has begun. The entire sum will be spent for special equipment.

Lee Rubber & Tire Corp.—Plans for the immediate construction of an 80,000 sq ft new plant addition costing $1,841,102 have been announced by Republic Rubber Div. Construction will begin immediately.

Robinson Clay Product Co.—An extensive plant expansion program in the Tuscarawas County area has been launched. It is designed to increase production of refractories and other clay products. The company also announced the reopening of Factory 7 at Malvern, Ohio.

Rockwell Manfacturing Co.—Construction of the new plant at Tupelo, Miss. was started and is to be completed by September. It covers 150,000 sq ft.

Sylvania Electric Products Inc.—Plans for a new metallurgical laboratory at Sylvania Center, the research site at Bayside, Long Island, N. Y. were announced. The new laboratory will cost between $1,000,000 and $2,000,000 and will contain 50,000 sq ft of floor space.

United States Rubber Co.—Naugatuck Chemical div. announced a major expansion program at the Baton Rouge, La., Paracril synthetic rubber plant. Work is expected to begin at once and completed by early 1952.

Westinghouse Electric Corp.—Transformer Div. at Sharon, Pa., is purchasing 6-3/4 acres of land adjoining the present plant area.

Plans for construction of a new plant near Madison, Indiana, were announced recently. It will be a one-floor structure providing 175,00 sq ft of floor space. Opening is set tentatively for mid-1952.

APPOINTMENTS

American Blower Corporation—J. C. Linsenmeyer, works manager, was elected v-p in charge of manufacturing. John Brennan was appointed chief engineer; E. W. Petersen was elevated to a newly-created post as assistant general sales manager; and Benjamin Ragland was made manager of the Hydraulic Coupling Div.

V. D. Anderson Co.—Three engineering executives, B. R. Wright, J. T. Odbert and M. J. Toth have joined the steam specialty div.

Bridgeport Brass Co.—L.E. Menns was made Pacific Coast sales manager. He will be in charge of their San Francisco district office and warehouse as well.

Centrifix Corp—C. L. Campbell, a veteran of 31 years in the chemical engineering fields, was appointed chief engineer. He will direct design development and will offer design and fabrication assistance for special applications in the industrial field.

Colorado Fuel and Iron Corp.—C. P. Harlow was appointed sales manager of the hardware products dept. of the Wickwire Spencer Steel Div.

The Cooper-Bessemer Corp.—T. E. Eagan has been promoted to a new position of research metallurgist. In his new post, Mr. Eagan will direct development work in the field of nodular iron and other engineering metals.

The promotion of I. W. Ferguson to manager, quality control, was recently announced, and at the same time, E. C. Phelps was elevated to assistant works manager. H. Johnson now becomes factory supt. and Harry Cecsarini, supervisor of routing and estimating dept.

T. E. Eagan S. R. Harper

Goodyear Tire & Rubber Co.— S. R. Harper has been placed in charge of sales promotion and advertising for the Mechanical Goods div., replacing R. W. Sabine, who has been promoted to mgr of distributors sales for the div.

De Laval Steam Turbine Co.—The following executive promotions have been announced. J. P. Stewart, former

executive v-p, has been elected president. W. A. Neumann, Jr. has been elected v-p of industrial sales and will be responsible for industrial and commercial sales. H. G. Bauer has been elected v-p of engineering and will also continue as manager of marine sales. He was previously v-p and executive engineer. Charles A. Jurgensen has been elected vice president of manufacturing. He will continue to serve as works manager.

Dravo Corporation—Appointment of C. R. Horton, Jr., as manager of the engineering development dept., of the Engineering Works Div. has been announced. He has been with the company in various engineering and production capacities and is a member of the Society of Naval Architects and Marine Engineers.

John T. Edelen is sales engineer in the Cincinnati office of the Machinery Div. He was assigned to the Kentucky area, including Louisville, and certain areas in Southern Ohio. Mr. Edelen also will represent the De Laval Steam Turbine Co.; C. H. Wheeler Div. of the Hamilton Thomas Co. and Walker Process Equipment, Inc.

Electric Steam Radiator Corp—The appointment of F. A. Stockwell as assistant to the president was made.

Elgin Softener Corp.—B. F. Willey is now industrial sales manager and V. J. Flood is now field sales supervisor.

Fairbanks, Morse & Co.—C. A. Mapp is now district manager of locomotive sales in the Chicago area.

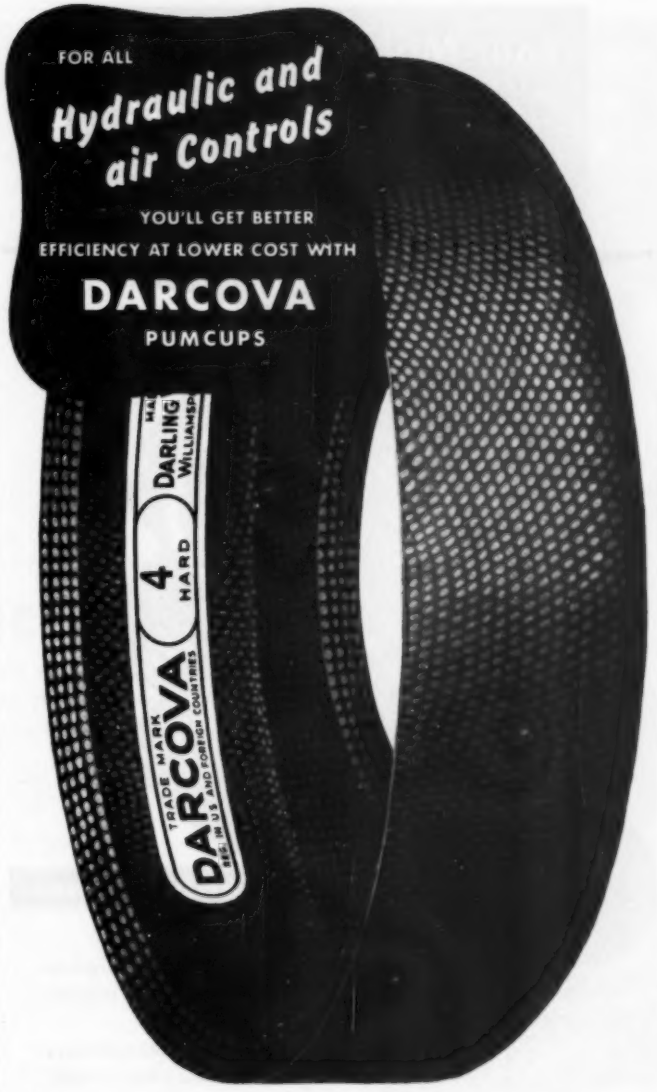
General Electric Co.—C. H. Lang, v-p, is now in charge of public relations. D. R. Shoults is director of the Co.'s Aircraft Nuclear Propulsion project for the Air Force and Atomic Energy Commission. H. L. Erlicher, v-p, was named special assistant to Under Secretary of the Army. W. A. Sredenschek is manager of materials and purchasing. A. T. Chandonnet was named manager of the Lynn Turbine Division. W. V. O'Brien, v-p, is manager of the Apparatus Marketing Division. D. C. Prince and H. L. Andrews, v-ps, have retired.

The B. F. Goodrich Co.—H. N. Stevens, formerly director of patents and abstracts at the Research Center in Brecksville, Ohio, has been named director of colloid and textile research. He assumes duties formerly directed by Dr. Harlan L. Trumbull who retired after 32 years of service as scientist and research administrator.

The Goodyear Tire & Rubber Co.—Appointment of M. J. Rhoad, a chemist in fundamental research, to the sales staff of the Chemical Div. has been announced.

The Insul-Mastic Corporation of America—G. A. Bulmer has been given the position of manager of the newly formed west coast branch. Headquarters will be in Los Angeles.

Jenkins Bros.—H. J. Dauphinee joined the valve sales staff. He will cover northern California territory, working out of the San Francisco office.



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APPOINTMENTS

(Continued from page 99)

Johns-Manville Corp.—C. B. Burnett is named director of engineering. He was formerly production manager of the Building Products div. A. K. Higbee has been appointed production manager of the Building Products div. and a v-p of the corporation. He will assume his new responsibilities on September 1, 1951.

Ketchum, MacLeod & Grove, Inc.—E. W. F. Feller, former managing editor of INDUSTRY AND POWER, has joined the public relations staff as an account executive.

The Kuljian Corp.—R. M. Lundgren has been appointed v-p. In his new capacity he will have charge of the sales program of the corporation.

H. H. Miller R. M. Lundgren

Worthington Pump and Machinery Corp.—H. H. Miller, manager of the Compressor div. in Buffalo, N. Y., has relinquished the managership of his div., to act as consultant to his successor, E. A. Murray. Mr. Miller plans to retire at the end of this year.

Leeds & Northrup Co.—Election of I. M. Stein to the newly created post of executive v-p is announced. He has been a v-p, and is director of research.

McDonnell & Miller, Inc.—J. W. James was elected vice president in charge of research.

National Aluminate Corp.—H. R. Powers, former district manager, is promoted to field manager of the industrial dept. I. A. Clausen will take over as district manager.

National Electric Products Corp.—V. P. Oatis, Jr., has been appointed sales engineer in charge of underfloor wiring systems.

Owens-Illinois Glass Co.—Robert P. Long has beeen named insulation engineer for the Kaylo Div. He now reports to A. V. Baber, manager, heat insulation sales. His headquarters will be in Toledo.

Four other men have been promoted in a sales department expansion move for the Kaylo Div. They are H. E. Casey, E. C. Shuman, W. R. Lugar and P. W. Boyd.

Struthers Wells Corp.—A. W. Burnite was apponted chief engineer of the Boiler Div. He formerly was chief engineer of Edge Moor Iron Works, Inc.

Westinghouse Electric Corp.— A Department of Information Services headed by D. McFeatters has been

formed. S. J. Merriman has been appointed assistant to the general manager of the East Pittsburgh Divisions of the corporation.

Worthington Pump and Machinery Corp.—W. J. Fleming is manager of the Construction Equipment Sales div. J. S. Bachman will continue in charge of field sales with the title of assistant manager. Both men will continue to make the Dunellen Works their headquarters.

H. E. Gallison succeeds J. C. Lukas as manager of the Industrial Mixer Sales div. Mr. Lukas has resigned.

American Chain & Cable Co.—V. Lysaght was named sales mgr of the Helicoid Gage Div.

The Dow Chemical Co.—A. J. McCoy is assistant production mgr, magnesium wrought products, of the Madison Div. R. B. Mounsey is magnesium sales representative in the Cleveland office.

Iron Fireman Mfg. Co.—B. B. Magee is director of U. S. sales.

OBITUARIES

Allis-Chalmers Mfg. Co.—Frank S. Schuyler, retired manager of the Detroit district office, died recently following a brief illness. He was 66.

The Goodyear Tire & Rubber Co.—Funeral services were held July 11 for Joseph W. Roberts, 58, assistant comptroller.

Gifford-Wood Co.—William E. Herb, v-p in charge of sales, passed away early in July.

Heller Brothers Co.—George F. Smith, 86, sales representative of the company for the southeast and southwest, died at his home in Baltimore.

O. S. Tyson and Company, Inc.—The death of Oscar S. Tyson, founder and chairman of the board, was announced.

American Floor Surfacing Machine Co.—L. F. Steele, advertising manager, fell overboard from his motor boat during the Fourth of July holiday and was drowned. He was 40 years old.

REVIEWS of RECENT BOOKS . . .

Recent books, published for men responsible for Engineered Plant Services, are reviewed here. Write to the publisher for those in which you are interested

Diesel Engines

"Standard Practices for Low and Medium Speed Stationary Diesel Engines," published by the Diesel Engine Manufacturers Association, One North LaSalle St., Chicago 2. Illustrated. Price $5.00.

This book is the product of member companies of the Diesel Engine Manufacturers Association which coordinated their engineering and sales departments and delegated representatives to rewrite the former treatise. Each of the seventeen chapters in the 1946 edition was carefully checked for any additions and needed clarifications. Besides these improvements there have been added sections dealing with dual fuel engines, operation and maintenance, starting systems, and a variety of new additions included in an appendix.

Chapter headings of the new book give an idea of its scope: definitions; performance and equipment; diesel engine construction; governors and speed regulations; torsional vibrations and critical speeds; intake and exhaust systems and heat recovery apparatus; starting systems; cooling water systems; lubricating oil systems; fuel storage and handling systems; generators and electrical equipment; selection of engine sizes; diesel power plant buildings; erection of diesel engines; lubricating oil characteristics and general specifications; field test codes; operation and maintenance. The book is written primarily for consulting engineers, buyers, users and manufacturers of Diesel engines and engine parts and accessory equipment.

Servomechanisms

"Introduction to Servomechanisms" by A. Porter, M. Sc., Ph. D., head of Research Department, Ferranti Electric Ltd., Toronto. Published by Methuen & Co., Ltd., London and John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. A pocket-sized monograph of 151 pages, illustrated with graphs, drawings and diagrams. Price $1.75.

Not intended for those who wish to specialize in the theory and design of automatic control systems and servomechanisms, the book is written rather for the physicist and engineer who is merely interested in the subject. It indicates, in terms of elemetary examples, the theoretical foundations of the subject, with particular emphasis on basic problems in servo design, namely, those of insuring adequate damping and small dynamic lags.

Mathematical treatment is avoided as much as possible to make a concise, easy reading text for the non-specialist who is usually more interested in physical principles than mathematics.

Synchronous Machines

"Synchronous Machines: Theory and Performance" by Charles Concordia. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York

IMPROVE CONTROL OF FLUID FLOW AND SHUT-OFF

24" stainless steel butterfly valve with Cono-Control air diaphragm operator and auxiliary hand wheel control; operation at high temperature.

20" rubber-lined butterfly valve with air cylinder and counterweight; for corrosive vapors at 215°F.

30" butterfly valve for 60 p.s.i. operating pressure; equipped with Janette electric motor operator.

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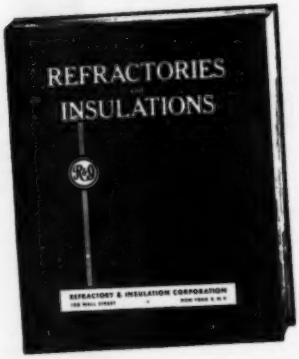

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16, N. Y. 219 pages illustrated with graphs. Price $5.50.

One of a series written by General Electric authors for the advancement of engineering practice, the book gathers material, hitherto available only as technical articles, into one unit. It develops the fundamental circuit theory of the transient performance of synchronous machines as currently used by engineers directly concerned with the prediction of machine performance. The general equations developed are applied to (a) the calculation of transient short-circuit currents and torques, (b) steady state power torque and current, both in synchronous operation and during starting and (c) voltage disturbances occasioned by sudden application of load.

Emphasis is placed on mathematical development and on obtaining a fundamental physical understanding of the behavior of synchronous machines to enable the reader to extend the theory and attack new problems as necessary. Examples show practical applications.

Arc Welding

"New Lessons in Arc Welding", published by The Lincoln Electric Co. 312 pages illustrated with photographs, and drawings and presenting considerable data in chart form. Price $1.00 in U. S. A., $1.50 elsewhere, order from recognized book dealers, Lincoln representatives or direct from the company, address, Cleveland 1, O.

Enlarged by the addition of new material, the book is based on the series of lessons in arc welding. The first part is a basic course on the fundamentals of arc welding mild steel in all positions. Another section is devoted to advanced courses in alloy, sheet metal and pipe welding. Also included is a "Welding Application Supplement", which is not made up of lessons but contains new procedure data for low cost welding, supplementary information on welding processes, and suggestions and designs for use of welding in place of casting in machinery.

Tool Engineers Handbook

"Tool Engineers Handbook," Frank W. Wilson, editor-in-chief, ASTE. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18, New York. Includes 2150 pages, 1500 illustrations, tables, charts, symbols, definitions and equations. Price $15.00.

Here is a reference volume that contains the latest in design, fabrication, maintenance, safety and economic use of tools and machinery in industry. Written for tool engineers and all others concerned with the mechanical production of industrial and consumers goods, it covers product design, estimating, economical selection of machines, processes and improvement of operations.

Arranged to give the complete answers in the shortest possible time in a style and presentation best suited to fast, easy usage. Factual data were collected from responsible sources, and includes data never before made available. Written by 144 of the best available authorities in the field and checked by a hand picked group of experts to insure accuracy.

MEETINGS and EXHIBITIONS

Meetings of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

AUGUST

American Institute of Electrical Engineers Pacific general meeting will be held at Multnomah Hotel, Portland, Oreg., Aug. 20-23. Technical sessions and inspection trips including the Bonneville Dam Power House, are scheduled. Write to H. H. Henline, AIEE, 33 West 39th St., New York.

Illuminating Engineering Society—National Technical Conference will be held Aug. 27-30 at the Hotel Shoreham, Washington, D. C. Fifty papers will be presented in nine technical sessions.

SEPTEMBER

National Instrument Conference and Exhibit will be held in the Sam Houston Coliseum in Houston, Texas, September 10-14. Write the Instrument Society of America, 921 Ridge Ave., Pittsburgh 12, Pa., for information.

American Society of Mechanical Engineers holds its fall meeting at Hotel Radisson, Minneapolis, Sept. 25-28.

OCTOBER

National Association of Corrosion Engineers holds the annual meeting of the South Central Region at Corpus Christi, Texas, October 18-20. G. A. Mills, Central Power and Light Co., is general chairman of the meeting.

American Institute of Electrical Engineers has scheduled the fall general meeting for Cleveland, Oct. 22—26.

American Standards Association will hold its National Standardization Conference in the Waldorf-Astoria, New York, Oct. 22-24. Emphasis will be on standards in national defense. Write ASA, 70 East 45th St., New York, for conference information.

NOVEMBER

23rd Exposition of Chemical Industries will use all available exhibit space on the exposition floors of Grand Central Palace, New York, from Nov. 26 to Dec. 1. Write Publicity Department, 23rd Exposition of Chemical Industries, Grand Central Palace, New York.

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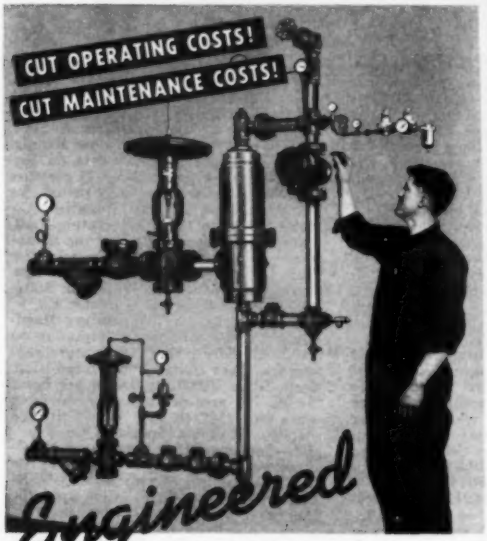

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ANY VOLUME OF WATER
AT THE TEMPERATURE REQUIRED!

Here's the money-saving answer to hot water required for industrial needs. PICK Heaters provide hot water *instantly* — by steam injection. They're entirely automatic to provide and accurately maintain temperatures up to 180° F. The exclusive Pressurizer Piston stabilizes injection pressure — eliminates pipe hammering and shaking. Available in seven sizes with rated capacities of 10 to 200 gallons per minute. Greater volumes can be obtained by multiple installations. Installation is simple, requiring only ordinary pipe connections.

NO STORAGE TANKS NEEDED
Compact design permits installation in corners, on walls or overhead.

EASILY CLEANED
No coils. Can be cleaned in a matter of minutes — without dismantling.

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BY PERFORMANCE IN
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Write for Engineering Details and Specifications Write Dept. IP4

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WEST BEND, WISCONSIN, U.S.A.

Dutton EconoTHERM
"PACKAGED" STEAM GENERATOR
WITH EXCLUSIVE OFF-CENTER FIRING
SHOWS BIG SAVINGS!

HERE'S WHAT OFFICIALS SAY AT W. B. PLACE & COMPANY, HARTFORD, WIS., CUSTOM DEERSKIN TANNERS:

"We are very much pleased with the Dutton gas-fired boiler . . . it has done an excellent job of heating, and been practically trouble free." As to cost of operation, *"our bills to date indicate a substantial saving . . . a big saving in labor."*

From the installation picture, you might compare the *appearance* of these boilers — but where *efficiency* begins, comparison ends! The compact Dutton EconoTHERM produces *160 h.p.*, against *90 h.p.* for the space-consuming old boiler beside it. From a cold start, the Dutton will produce 125 lbs. of steam pressure in just 15 minutes. The old unit took 2½ hours!

In Hartford — or wherever they're installed — "packaged" EconoTHERMS win praise for fuel efficiency, safety and durability. Delivering *twice* the power you'd expect in *half* the usual space, the EconoTHERM is self-contained, with fully automatic controls.

Exclusive Dutton "off-center firing" with rotary combustion gives you faster boiler water circulation, plus greater safety. Other features include: Large steam storage space . . . five or more square feet of water heating surface per rated h.p. . . . mechanical draft with short stack (no costly chimney) and choice of gas or oil firing.

Learn about *all* the quality features of the Dutton EconoTHERM . . . WRITE NOW FOR BULLETIN EC-100B

Other types and sizes — 5 to 250 h.p.

Dutton BOILER DIVISION
HAPMAN-DUTTON COMPANY
KALAMAZOO • MICHIGAN
Boiler Makers Since 1880

readers' guide to advertised products

Here you'll find, briefly reviewed, all the booklets and leaflets offered in the advertising columns of this issue of INDUSTRY AND POWER. For easy reference, this listing is divided into various classifications of products. To get your free copies of literature described here and in the corresponding advertisements, list the key numbers of the paragraphs on the cards between pages 92 & 93.

AIR & DUST FILTERS & COLLECTORS

500—See page 97. Dust and Fume Control Systems: Send for free booklet, "Dust Collecting Systems in Metal Industries". Shows typical installations and exact data that will help you control these problems better in your own plant. Kirk and Blum Mfg. Co.

501—See page 113. Fly Ash Collector: 'LR' Fly Ash Collector designed especially for small boilers—collects 99% of all 100-mesh cinder discharge. Fits small plant's boiler room. No cleaning, no water. Write for complete facts. Buell Engineering Company.

ANTI-CORROSIVE & PROTECTIVE COATINGS

502—See page 9. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete information. Rust-Oleum Corporation.

BOILERS & BOILER ACCESSORIES

503—See page 116. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

504—See page 31. Mechanical Draft Equipment: Write for further details on Sturtevant Forced Draft Fans, Erosion-Resisting Induced Draft Fans, and power-saving Vane Control that give you dependability and outstanding performance. Westinghouse Electric Corp., Sturtevant Division.

505—See page 125. Steam Generators: Wickes can fill your exact requirements for boilers of any type up to 250,000 lbs. steam per hour and 850 psi. Write for descriptive literature on the famous Wickes line of steam generators. The Wickes Boiler Co.

BUILDING HEATING, VENTILATING & AIR CONDITIONING & REFRIGERATION

506—See Page 43. Trane Equipment: Whatever your factory heating, ventilating, cooling or air conditioning problem is, look first in the answer in the Trane line. An inquiry will bring you complete data on equipment engineered for your particular job without obligation. The Trane Company.

BUILDING MATERIALS & MAINTENANCE

507—See page 119. Pipe Joint Sealing Compounds: Pipe joints and fittings sealed with Key sealing compounds do not leak. Connections will not freeze and reopening is easy. Send for free sample. Key Company.

508—See page 122. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and "Hand Book of Building Maintenance". Flexrock Co.

509—See page 118. Free Repair Handbook: 40 pages describing Smooth-On repairs that can save you time and money. 170 illustrations. Write for your copy now. Smooth-On Mfg. Co.

COAL, ASH & BULK HANDLING

510—See page 58. Conveyors: If you have a simple unloading system, or a large and complicated conveyor layout, Fuller engineers are capable of handling the job. The Airveyor will handle large or simple unloading systems for dry bulk material handling. Fuller Co.

COMPRESSORS

511—See page 37. Schramm Compact Compressors. Mail coupon on page 37 for Free Booklet C-50B for complete installations. A neat, compact package that can be installed wherever motor current is available. Sizes ranging from 1/3 to 100 hp. Write Schramm, Inc.

CONTROLS, REGULATORS & INSTRUMENTS

512—See page 112. RANAREX Indicator and Recorder: For a quick, dependable check on CO_2 content of flue gases, use RANAREX. A sure check that is accurate to within 2/10 of 1% of CO_2. Uses no chemicals. Sturdily constructed and easily maintained. Write for booklet. The Permutit Co.

513—See page 109. All-Metal Thermometers: Write for complete data on these easy-to-read ruggedly constructed thermometers for most industrial applications. Wide variety of types. Literature also describes electrical and glass thermometers. Weston Electrical Instrument Corporation.

514—See page 122. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

515—See page 46. Pressure and Temperature Control: Type ED pressure regulators assure accurate, dependable control with maximum money-saving performance. In sizes ¼" to 12" for service with air, steam, water, oil or gas. Write for complete details. Spence Engineering Company, Inc.

516—See page 116. Flow Indicators: Henszey indicators have only three moving parts! This means longer wear, continued service and constant accuracy. Write for details. Henszey Co.

517—See page 15. Traction Dynamometers: Since 1835, John Chatillon & Sons have been world famous for the precision manufacture of force measuring devices which meet the most specific requirements of industry. Fill in and mail the coupon shown on page 15 for the complete brochures you need in your plant. John Chatillon & Sons.

518—See page 115. Pressure Regulators: Write for complete data on Mason-Neilan No. 515 and No. 11 pressure regulators. Ruggedly constructed for long life. Mason-Neilan Regulator Co.

519—See page 110. Temperature Indicating Regulators: Combine the advantages of easy-to-read dial thermometer with dependable, self-operating regulator. Easy to install. Write for Bulletin 329. The Powers Regulator Co.

520—See page 32. Temperature Regulators: Write for more information on Hoffman Series 1100 temperature regulators. Sizes from ½" to 5" inc. Cap. from 50 to 50,000 lbs. steam per hour. Series 710 pressure reducing valves in sizes from ½" to 1¼" inc. Write for details. Hoffman Specialty Co.

521—See page 118. Oxygen and CO_2 Analysis: This newly developed Fyrite Test Set comprises two separate indicators—one for direct CO_2 analysis, the other for direct Oxygen analysis. Both employ fundamental principle of chemical absorption. Portable; require no setting-up, have no valves or leveling bottle to manipulate. For complete particulars write for leaflet 700-342. Bacharach Industrial Instrument Co.

522—See page 111. Industrial Controls: Meet this important A-H family of industrial controls, that is playing a vital role in industry's efforts toward increased production at lower cost. Send today for engineering data and product literature on the A-H controls in which you are interested. The Arrow-Hart & Hegeman Electric Co.

523—See page 120. Temperature Regulators: Write for Stacon Bulletin 50-100 for full details on extra sensitive, accurate, economical temperature regulators. Farris Stacon Corp.

524—See page 118. Automatic Controls: Write for Catalog No. 700 for information and data on this complete line of automatic controls for heating, air conditioning, refrigeration and industrial applications. Mercoid Corp.

DIESELS

525—See page 38. 4-Cycle Supercharged Diesels: Ask for details and proof that these engines will supply more kilowatt hours per gallon of fuel oil. Write today. Worthington Pump and Machinery Corporation, Engine Division.

ELECTRICAL DISTRIBUTION

526—See pages 22, 23. I-T-E Switch-

(Continued on page 106)

They Save $358.54 a Month by not Pulling this Switch

Every day the machinery in a Clinton, Mass. plant* had to be stopped for a half hour while those machines were lubricated. Every stop meant lost production time plus a $14 expenditure for lubrication.

The Clinton people called in an Alemite Lubrication Engineer. They wanted to know if they could eliminate the costly interruption in production time. They felt that lubrication was costing them too much.

The Alemite Lubrication Engineer studied their problem and recommended a system that automatically lubricates the machinery without any shut-down. What's more, lubrication cost was cut from $14 a day to only 21c a day. That saving alone paid for the entire investment in just 43 days.

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No matter what size or type of plant you operate, Alemite can show you dozens of ways to save through the more efficient handling of petroleum products. Call your local Alemite Industrial Distributor now or send for the free booklet "11 Ways to Cut Production Costs." Simply attach the coupon below to your letterhead. Dept. M-81, 1850 Diversey Parkway, Chicago 14, Ill.

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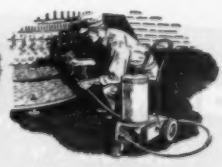

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...are made of high-test alloy iron to withstand the action of many of the strongest chemicals such as concentrated sulfuric acid, alkalies, aniline oils, sodium and potassium cyanides and creosote. These iron body valves give long service under the severe operating conditions that exist with use of these destructive agents.

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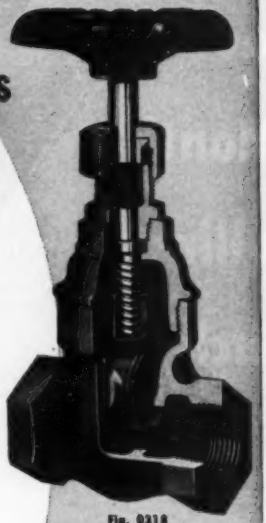

Fig. 0318
ALL IRON GATE VALVE
150# SWP 225# WOG
Non-Rising Stem • Solid Wedge • Taper Seat
½"-2" Sizes

Fig. 0904
ALL IRON GATE VALVE
125# SWP 200# WOG
Solid Wedge • Taper Seat • Malleable Iron Seat Rings
2"-12" Sizes

Fig. 0418
IRON BODY U-BOLT GATE VALVE
150# SWP 225# WOG
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CASTERS • TRUCKS • VALVES • DART & PIC UNIONS

(Continued from page 104)

gear: See pages 22, 23 for an interesting description of the progressive Research and Development Tower of S. C. Johnson & Son. Protecting this power distribution system are an I-T-E coordinated outdoor substation, two I-T-E indoor unit substations, and an I-T-E distribution panelboard. Full details on I-T-E Switchgear available. I-T-E Circuit Breaker Co.

ELECTRIC HEATING UNITS

527—See page 45. Electric Heaters: Send for Catalog 50 and the useful booklet of application ideas "100 Ways to Apply Electric Heat". No obligation. Edwin L. Wiegand Company.

FANS AND BLOWERS

528—See page 7. Blowers: Check and mail coupon on page 7 for full information on how Coppus blowers or exhausters supply fresh air to men working, and step up production. Coppus Engineering Corp.

529—See page 2. Vaneaxial Blower: Get the complete economy of Hartzell Vaneaxial Blower design and construction. Economy begins with purchase price and installation and saves your money year after year. Easy to install. Mail coupon on page 2 for complete data. Hartzell Propeller Fan Co.

FUELS & FIRING EQUIPMENT

530—See page 107. Fuel Oil Additive: Houghto-solv is Houghton's proven additive for treatment of fuel oil systems to remove sludge by taking it into solution and actually making it burnable. Mail coupon on page 107 for sample test and full information. E. F. Houghton & Co.

531—See page 40. Underfeed Stokers: For over 25 years Canton Underfeed Stokers have been operating efficiently in practically every type commercial and industrial buildings. 54 types and sizes to choose from. All engineered for top efficiency in your specific installation. Write today for details. Canton Stoker Corp.

532—See page 17. Beacon Combustion Service: If you are thinking of expanding your boiler house facilities, consult the Beacon Combustion Service Man for information on available fuels, plus reports on the experience of other engineers with equipment, that will help you make a smart decision. Eastern Gas and Fuel Associates.

533—See page 57. Combination Gas & Oil Burners: Write for literature on the John Zink Series CBM, Y and YC combination gas and oil burners and the John Zink patented ST gas burner. There is a John Zink burner for every heating and power need. Write today. John Zink Company.

HEAT EXCHANGER EQUIPMENT

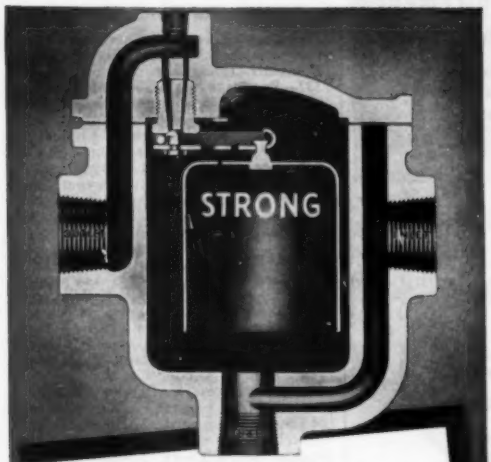
534—See page 110. Cooling Towers: Pritchard towers guaranteed to meet your peak as well as normal load requirements—effect maximum saving of water. Write for free bulletins today. J. F. Pritchard & Co.

535—See page 103. Instantaneous Water Heaters: Engineered for all industrial needs. Provides hot water instantly at the temperature required in the volume needed. Write for complete engineering details and specifications. Pick Manufacturing Co.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

536—See page 120. Lubriplate: Write today for authentic information on how these lubricants effect maximum sav-

(Continued on page 108)



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STRONG* 70 Series Traps give better service!

Look to these five reasons for long, trouble-free service in STRONG 70 Series Traps:

1. *Valve and seat guaranteed leakproof for one year—made of STRONG's patented, wear-resistant Anum-Metl;*
2. *Easy servicing—permitted by the renewable seat design, cover with all working parts easily removed without breaking pipe connections;*
3. *One piece bucket—stainless steel, no welds;*
4. *Turbulence avoided, choking minimized, 25% greater capacity—with STRONG's exclusive Hi-Cap orifice;*
5. *No dribbling, quick, full opening—high ratio leverage.*

STRONG *in-line* 70 Series Traps are available in sizes from ½" to 1", semi-steel construction. STRONG's "two-in-one" blast trap with integral thermal air vent is also available in the 70 Series (see cut below).

Catalog No. 68-J describes these traps in detail along with other STRONG traps. Write today.

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You pay for SLUDGE too . . .

HOUGHTON
HOUGHTO-SOLV lets you burn it!

1st **DISSOLVES SLUDGE** ten times *faster*

2nd **SUSPENDS SLUDGE** in *permanent* solution

3rd **PREPARES SLUDGE** for *complete* combustion

Every gallon of Houghto-Solv keeps up to 4000 gallons of fuel oil free of damaging sludge. Permits you to burn all the fuel oil you buy. Saves you money every minute!

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Without cost to us, please send:
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The PERFECT SEAL

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(Continued from page 106)

ings even in unusually severe lubrication problems. Fiske Brothers Refining Company, Lubriplate Division.

537—See page 85. Lubricants: Sunvis 900 Oils are good for the life of your machine. Designed for toughest lubrication jobs throughout industry. Write today for booklet. Sun Oil Co.

538—See page 103. 11 Ways to Cut Production Costs: Write for your copy of this free, new booklet which is yours without obligation. You will find handy coupon on page 105. Alemite Corp.

MECHANICAL POWER TRANSMISSION

540—See page 3. V-Belts: Ask Goodyear about HY-T Multi-V-Belts for normal speed, heavy shock-load drives; Goodyear also features other V-Belt constructions to meet specific drive demands. Write for details. The Goodyear Tire & Rubber Co.

541—See page 25. Condor V-Belts: Bulletin 6868 D describes all advantages of these Whipcord V-Belts — less stretch on your drive, grip pulleys snugly and deliver positive power. Write. Raybestos-Manhattan, Inc.

542—See pages 49, 50, 51, 52. B. F. Goodrich Grommet Belts: These V-belts, because of an entirely different construction principle, stand more shocks and heavier loads than any other kind—last 20 to 50 per cent longer, depending on service—have more rubber, are more flexible, and give better grip. Read pages 49, 50, 51, and 52 for interesting data about the money-saving Grommet V-belts and write for complete data and prices. Industrial Products Division, The B. F. Goodrich Company.

PACKAGED STEAM GENERATORS

543—See pages 12, 13. Steam Generating Units: Select Riley equipment for efficient, trouble-free performance that cuts operating costs to minimum. Write today for further information. Riley Stoker Corporation.

544—See page 92. Packaged Steam Generators: New, fully illustrated Catalog 302 gives complete details for units available in 18 sizes. Write today. Superior Combustion Industries, Inc.

545—See page 26. Forced Recirculation Steam Generators: See page 26 for outstanding features of this Clayton self-contained steam plant. Use the coupon to request a desk demonstration of Clayton Forced Recirculation principle and/or catalog. Clayton Manufacturing Company.

546—See page 103. "Econotherm"—Oil or Gas Fired: Self-contained unit, shipped complete with all equipment necessary for low cost installation. Write for Bulletin EC-100B. Hapman-Dutton Company, Dutton Boiler Div.

547—See page 34. Packaged Boilers with Horizontal Rotary Oil Burners: Bulletin 175 tells the complete story of this burner specially designed for firing in the elongated furnace of a packaged boiler. Bul. 1000 describes in detail other engineering features of steam generators. Get both bulletins. Preferred Utilities Mfg. Corp.

PACKINGS & GASKETS

548—See page 99. Piston Packing: Pumcups cut downtime and material and maintenance costs to minimum, hold volumentric efficiency constant. Write for free bulletin. Darling Valve & Mfg. Co.

549—See page 95. Navalon Packings: Made of "ramie", these packings give service against fresh or salt water, brine, cold oil, and for use on pumps, elevators, etc. Write for folder PK-32A. Johns-Manville.

PIPE AND FITTINGS

550—See page 39. Flexible Metal Hose: CMH Rex-Weld Type RW-75 is helically corrugated flexible steel hose. Sizes from 5" to 24" I.D., inclusive. Furnished with standard pipe nipples, couplings, fixed or floating flanges. Write for full information and data sheets. Chicago Metal Hose Corp.

551—See pages 28, 29. Gun-Pakt Expansion Joints: Send for free Bulletin EJ-1912 for the full story on Yarway Expansion Joints. Insert a plug or packing, turn a wrench, the joint's tight all under full steam pressure. Write today. Yarnall-Waring Co.

552—See page 114. Ball-Bearing Swivel Joints: Catalog No. 50-C gives full information on more than 500 different types, styles and sizes of Chiksan Ball-Bearing Swivel Joints. Write today. Chiksan Company.

553—See page 100. Pipe Unions: Bronze-to-bronze ball joints insure long life and tight joints. Because of precision manufacture these unions can be disconnected and reinstalled many times. Send for complete information today. Dart Union Company.

554—See page 108. Pre-fabricated Piping: One, convenient source for any industrial requirement in piping. Write for data on this complete service. Albert Pipe Supply Co., Inc.

555—See page 124. Flexible Metal Hose & Tubing: Write today for Bulletins SS-50 and CC-300 for more data on these flexible connectors for almost any liquid, gas or semi-solid. American Metal Hose Branch, The American Brass Company.

PUMPS

556—See page 98. Difficult Pump Problems: Marlow specializes in manufacturing pumps which solved some of industry's most perplexing pumping problems. Write for complete details. Marlow Pumps.

557—See page 91. Non-Clogging Centrifugal Pumps: Write for complete information on these Centrifugal Non-Clog pumps used wherever liquids carrying solids and foreign materials must be handled. Consult a Weinman Centrifugal specialist. No obligation. The Weinman Pump Mfg. Co.

558—See page 120. New Condensed Pump Catalog: Write for your copy of the condensed Catalog "M". Aurora invites your special pump problems which will be handled efficiently by personnel devoted exclusively to pump design and manufacture. Aurora Pump Company.

REFRACTORIES

559—See page 102. Refractories and Insulations: Write for free catalog with complete information on the use of castable, bonding and ramming refractories, and block, blanket, plastic and fill insulations. Refractory and Insulation Corp.

SOOT BLOWERS & TUBE CLEANERS

560—See page 117. Tube Cleaners and Expanders: Write today for complete information on Airetool cleaners and expanders for every type of tubular construction. Airetool Mfg. Co.

589—See page 4. Soot Blowers: Write for Catalog No. 1014 for complete data on Diamond G9B Soot Blowers. Diamond Power Specialty Corp.

WESTON *Readable* ALL-METAL THERMOMETERS

—AVAILABLE IN THESE 3 TYPES

STANDARD INDUSTRIAL THERMOMETERS

All-metal dial types with stainless steel stems, in straight and angle forms. Scale lengths 3"—6" and 9", with stems from 2½" to 72". Available as testing thermometers, and for general purpose and heavy duty service. Ranges from −100 to +1000°F. All-metal construction prevents breakage, assures dependable accuracy for longer periods.

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Combines the features of the all-metal indicating thermometer with an alarm or control device. Has adjustable contact arm mounted in the glass and bezel. Supplied to make contact on increasing or decreasing temperatures. Has positive magnetic type contacts. Contact rating . . . 100 ma at 110 volts a-c; 50 ma at 110 volts d-c. Stem lengths 2½" to 24".

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Equipped with a manually set red index which moves up or down scale with pointer, remaining at extreme temperature reached until reset. Thus one reading gives present temperature, and maximum or minimum reached since last reading. Available in scale lengths of 6" and 9"—stem lengths 2½" to 24".

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WESTON *Instruments*

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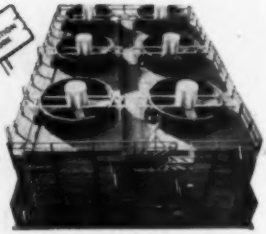

Wherever heat is to be dissipated to the atmosphere, you can depend on a Pritchard Cooling Tower to do the job more efficiently and economically at *water savings up to 99% over former wasteful methods!*

Adequately sized, thoroughly engineered and manufactured of highest quality materials, Pritchard Towers are guaranteed to meet your peak as well as your normal load requirements.

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Stops Losses Caused by OVER-heating

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—need no compressed air or electricity for their operation

SIMPLIFY your temperature control problems with Powers No. 11 Regulators. They're easy to install. Use them wherever you want a rugged, self-operating control to maintain a constant temperature.

Better Temperature Control—and extra years of dependable service are assured by: 1) Easy to read 4" dial thermometer shows temperature of liquid or air being controlled, makes it easy to adjust regulator for proper temperature. 2) Has valve stem lubricator. 3) OVER-heat protection. 4) Temperature adjustment has OILITE thrust bearing.

Available also without dial thermometer in a variety of 60° F. ranges and valve bodies ¼" thru 8".

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SELF ACTING CONTROLS TEMPERATURE of LIQUIDS or AIR
Simple • Economical • Dependable

POWERS

STEAM SPECIALTIES

561—See page 60. Impulse Steam Traps: To get equipment hot and into production faster, use Yarway impulse steam traps. Write for your free copy of new 16-page Trap Selector together with full information on how these traps keep equipment continuously at peak operating temperatures. Yarnall-Waring Company.

562—See page 119. Thermostatic Air Vents: Remove air from steam heated machines with Sarco thermostatic air vents. Write for Bulletin 276 and the name of the Sarco man nearest you. He can help you select the best vent for your purpose and the right place to install it. Sarco Company, Inc.

563—See page 107. Trap Catalog: Look to the five reasons for long, trouble-free service in STRONG 70 Series Traps on page 107. Write for Cat. No. 68-J. Strong, Carlisle & Hammond Co.

564—See page 120. Steam Specialties: Illinois Float and Thermostatic Traps are made in three series to meet a wide variety of applications. Complete data gladly sent upon request. Illinois Engineering Co.

565—See page 30. Steam Traps: Unique Duo-Step design doubles drainage capacity to give you double value—lets you use smaller, less expensive traps to do larger drainage jobs. Send for complete information today. The Clark Manufacturing Company.

567—See page 33. AIRXPEL Steam Trap: In sizes up to 2 in. and pressures to 700 psig. Capacities to 34,500 pounds of water per hr. Complete specifications and application data in Catalog 600. Write today. Wright-Austin Co.

568—See page 126. Steam Traps: Super-Silvertops save you money in two ways—cut down installation costs and keep operating costs low. Write for helpful book, "Solving Steam Trap Problems." The V. D. Anderson Company.

TOOLS

569—See page 108. Dura Hooks: An easier way to remove packings. Write for Bulletin DHIP covering sizes and prices. Durametallic Corp.

570—See page 119. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. Write Clements Mfg. Co.

TURBINES

571—See page 54. Terry Turbines: Read the case history of turbine economy at Narragansett Brewery on page 54. Ask for complete data to prove how you can profit. The Terry Steam Turbine Co.

VALVES

572—See page 59. Crane Valves: Dependable quality Crane valves insure low maintenance costs. Ask your Crane representative for a demonstration or write for full details. Crane Co.

573—See page 44. Gate Valves: Write for complete information on Series 12100 valves for 150-800 pounds general service. Sizes ¼" to 2" incl. Henry Vogt Machine Co.

574—See page 106. All Iron Gate Valves: Made of high-test alloy iron to withstand the action of many of the strongest chemicals. For full details write today. The Fairbanks Co.

575—See page 101. Butterfly Valves: Write for catalog describing complete line of standard valves to 72" pipe size—manual or automatic controls. W. S. Rockwell Co.

576—See page 53. Check Valves: Write

today for catalog with complete technical information on Chapman Tilting Disc Check Valves. The Chapman Valve Manufacturing Co.

577—See page 112. Williams-Hager Check Valves: Available for every service in standard pipe sizes from 1" to 20". Write today for Bulletin WH—100. The Williams Gauge Co.

578—See page 27. Diaphragm Valves: Sizes from ¾ to 14" for manual, automatic or remote operation. Choice of 13 diaphragm materials, 48 body materials. Write for complete information. Hills-McCanna Co.

579—See pages 86, 87. Valve Impactor Handwheel: Gives from 2.8 to over 12 times the force of an ordinary handwheel to close valves. Now standard equipment on most 900, 1500 and 2500 lb Edward Valves, 2½ in. and up. Write for full facts. Edward Valves, Inc.

WATER TREATMENT

580—See page 48. Worthington Hot-Z System: Tell us your conditions of service and get our recommendation in terms of dollars and benefits. Write today. Worthington Pump and Machinery Corporation.

581—See page 6. Boiler Water Comparators: Low cost, extreme accuracy, simple operation. Write for booklet "Modern pH And Chlorine Control". W. A. Taylor and Co.

582—See page 55. Write for Bulletins: (1) Dearborn Improved Polymide Anti-Foams, and (2) Dearborn Industrial Water Treatment and Engineering Service. Convenient coupon on page 55. Dearborn Chemical Company.

583—See page 119. Water Treating Equipment: Get your copy of fact-filled bulletins giving complete data on manual or automatic equipment in all sizes, types and capacities. Hungerford & Terry, Inc.

584—See page 41. Water Softeners: "Double-Check" line of softeners feature newly designed manifold and high-capacity zeolite. Applicable to your present softener for savings and extra capacity. Write for Bulletin 610. Elgin Softener Corp.

585—See page 11. Nalco Water Treatment: Send for Bulletin 49. Tells you how Nalco system will prevent costly difficulties caused by scale and corrosion. Bulletin 46 covers Nalco SR-fuel oil additive. National Aluminate Corp.

586—See page 21. Drew Water Treatment Service: Starts with the conditions that exist in your plant and includes all the corrective and preventive measures required for efficient operation. Write for new illustrated Drew Organics Folder describing the use of organics in modern boiler water treatment. E. F. Drew & Co., Inc.

587—See page 93. Zeolite Softeners: Send coupon on page 93 for Publication 4520 which gives complete information on Cochrane Zeolite Softeners. Cochrane Corporation.

WELDING & CUTTING EQUIPMENT

588—See page 47. Cutting Attachments: For trimming, shaping, beveling, groove-cutting. Attachment and heads fit same blowpipe handle. Write for details. Linde Air Products Company.

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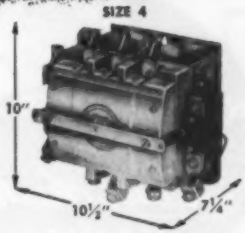
Arrow-Hart makes a complete line of motor starters and contactors — manual, magnetic, 2-speed and reversing. A-H Type "RA" starters feature an exclusive mechanism which reduces size by ⅓, while adding to dependability and performance. Available in sizes 0, 1, 2, 3, 4.



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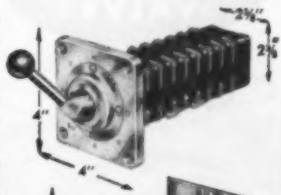
The A-H "PPS" provides a single point of control for multiple-operation machines—eliminates wasted time and effort of the operator, saves space, simplifies and reduces cost of control. Up to 16 dial positions available. Custom built to your requirements from standard components.



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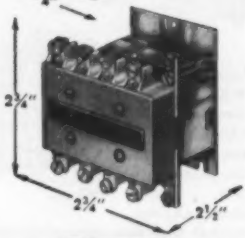
Inches smaller, every inch a champion. More compact, more versatile, more adaptable than any contactor on the market. Can be instantly altered to suit specific circuit requirements. Self-same contacts may be reversed to alter circuits. Simple wiring, mounting, connecting. 4 or 8 pole arrangements without additional panel space.



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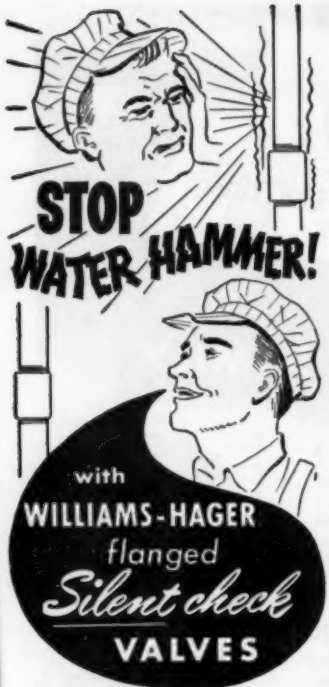

You can install Williams-Hager flanged Silent Check Valves in your water system in any position . . . horizontal, angular, vertical with flow upward or downward . . . and put an end to costly and annoying water hammer. Easy to install or reseat without special tools, they are durable and compact with easy accessibility and low friction. Available in standard pipe sizes from 1" to 20". Investigate the many features of these valves . . . and save!

Write today for Bulletin WH-100.

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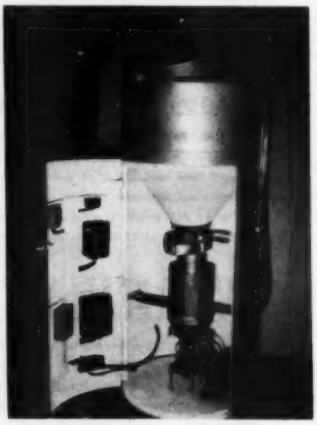
NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 20)

AK-1 hook-on volt-ammeter and AK-2 hook-on wattmeter, is designed for use where maintenance of high power factor is important. Small, light and portable, the meter locates easily those circuits where corrective action is needed.

33—SYSTEM CONTROLS FLYASH AND SMOKE

Introduced by the OXI Corp., the Vac-U-Turbulator makes use of Oxi crystals and turbulence to reduce the emission of smoke and flyash from smoke stacks and to help keep furnace walls clean. The crystals introduced into the swirling atmosphere provided in the combustion chamber chemically combine with flyash to create a sulphate compound. The melting point of this compound is higher than that of the flyash, making it a relatively non-sticky substance which does not adhere to boiler surfaces with which it comes in contact.



The equipment will create the proper turbulence and combine the oxygen and carbon in furnace gases. Turbulence can be regulated to the proper distance to penetrate the gases, to inject the proper amount of over fire air, to slow gas velocity, to permit more time for complete combustion, and to drop ash to the grate area instead of permitting it to enter the tubes.

The cabinet model shown is 30 in. in diameter and can be located at any distance from the boilers. Results which can be expected are: control of smoke; elimination of slag trouble and fire scale deposits; and complete combustion in the furnace with consequent savings in fuel and maintenance.

34—MOLDED PACKINGS GIVE PRECISION

A line of molded packings for hydraulic and pneumatic equipment is announced by Periflex, Inc. They are compression molded from special fabric and neoprene compound that has unusual wear qualities and resistance to a wide variety of hydraulic fluids.

Designs available include cup, flange, "U" ring and "O" ring. Hundreds of pre-

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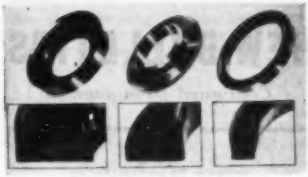
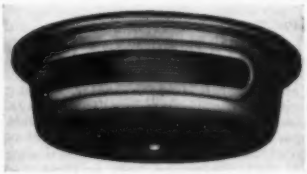


cision steel molds in standard sizes are stocked to assure prompt delivery in any quantity and the company operates its own tool room for machining molds for sizes and shapes not stocked.

35—DIFFUSER CONTROLS COOL AIR FLOW

Manufactured by the W. B. Connor Engineering Corp., this diffuser handles air at high pressures and high velocities, permitting the use of unusually small, exposed

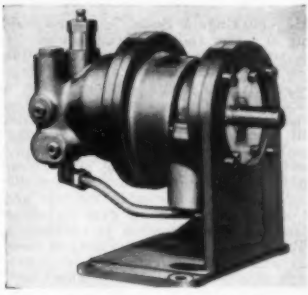


ducts of uniform size. A smaller volume of air at low temperature provides the cooling effect ordinarily requiring a greater amount of air at a higher temperature.

36—CONSTANT DELIVERY PUMPS RATED 5000 PSI

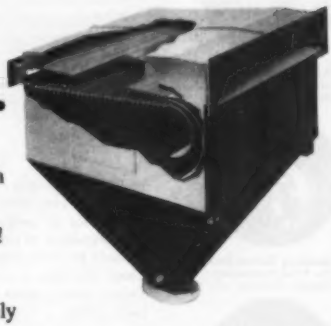
Simplification and compactness are features in Oilgear Company's three heavy-duty Type "HG" axial rolling piston pumps. With fewer working parts, they operate quietly at speeds up to 1800 rpm. Provided with pressure and flood lubrication by the high grade oil in the system, they provide service and endurance for pressures up to 3000 and 5000 psi.

The units are of the fixed stroke type, the volume delivered varying with the drive shaft speed. Each unit consists of an axial



rolling piston pump, a supercharging gear pump, a gear pump relief valve and an adjustable reverse flow type high pressure relief valve. Over 10 hp is transmitted by units only 7x10x13 in. About 135 cipm excess gear pump oil at 100 psi is available for auxiliary purposes. Pump, work and machine are protected against overload. They are especially suitable for heavy-duty pushing, pulling, lifting, and lowering applications, and for maintaining high static loads on large clamping rams and the like.

"What?... an efficient Dust Collector designed especially for small boilers from 100 to 2000 BHP?"



THERE SURE IS...

The *new* Buell 'LR' Fly Ash Collector gets 99% of all 100-mesh cinder discharge!

Boasts draft loss so low, you can even use it effectively on natural draft boilers!

For full information on how the Buell 'LR' Collector can help solve your Fly Ash Problem, write today to: Buell Engineering Company, Dept. 90-H, 70 Pine Street, New York 5, N. Y.

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Standard Swivel Joints. For pressures from 125 psi. to 15,000 psi.

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Rotating Joints. For 150-lb. steam, brine, etc. Adapted for siphon return line.

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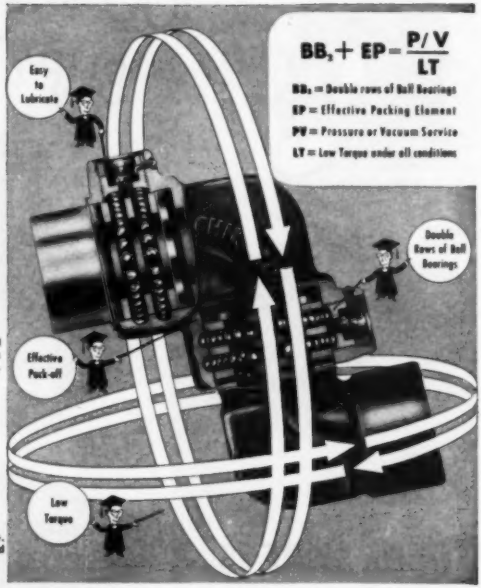
Hydraulic Swivel Joints. For pressures to 3,000 psi.


BB, + EP = P/V / LT
BB, = Double rows of Ball Bearings
EP = Effective Packing Element
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Easy to Lubricate
Double Rows of Ball Bearings
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For over a quarter-century, here at CHIKSAN, we have specialized *exclusively* on developing and designing Swivel Joints* for all purposes . . . on manufacturing them to our rigid standards of precision . . . and on following through in the field to check performance under all sorts of conditions. That's why there is no substitute for CHIKSAN *Ball-Bearing* Swivel Joints* when it comes to efficient service with maximum safety . . . longest life . . . and minimum maintenance.

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BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

NEW BULLETINS

(Continued from page 33)

POWER TRANSMISSION

248—Magnetic Drive. Bulletin 1107 is a 32-page publication titled "Precision Speed Control with the Adjustable-Speed Magnetic Drive." The book is technical in scope, and contains complete information both on the magnetic drive and the magnetic amplifier Regutron speed control. Technical information is clarified through the use of many charts, diagrams, and illustrations. Illustrated section covering industrial applications also included. Electric Machinery Mfg. Co.

249—Roller Bearings. Engineers and specifiers of industrial roller bearings and mounted units will be interested in 56-page catalog 51. Fully illustrates and describes full line of roller bearing units plus unmounted roller bearings. Design features such as concave rollers operating between matched convex races, and the advantages of this design are fully discussed. Of interest are larger models of bearing units with standard shaft sizes now available up to 5-in. dia. Also contains complete engineering and load rating data and illustrates many product applications. Shafer Bearing Corp.

250—Chain Drives. Unless a chain is properly installed and operated . . . given periodical inspection, lubrication and adjustment it will not give 100% satisfaction. How best to accomplish this is pointed out in bulletin 51-7, entitled "Installation, Operation and Maintenance of Chain Drives and Conveyers". Illustrations show correct and incorrect ways of solving chain installation, operation and maintenance problems. Chain Belt Co.

PUMPS AND ACCESSORIES

252—Packings & Seals. Improved sealing of power and processing equipment is supplied by anti-frictional, self-lubricating, flexible metallic packing, says series of bound catalogs. Covers flexible metallic packing, semi-metallic plastic packing, rotary mechanical seals, oil circulating systems and packing tools. Each bulletin tells how to apply and maintain the packing style used, and lists recommended uses for specific conditions. Of particular interest are 4-pages of engineering data including such useful information as conversion tables, areas of circles, weights of metals and liquids, steam temperature at various pressures. Durametallic Corp.

253—Vertical Turbine Pumps. Wet-pit pumps, designed for applications where medium to high operating heads are required in a minimum of floor space, are the subject of 8-page bulletin 7228. Lists advantages, applications, construction and design features. Sizes from 10 to 30 in. in semi-open impeller type with capacities to 15,000 gpm and pressures to 250 psi. Dimension table and installation photos shown. Ingersoll-Rand Co.

254—Reciprocating Pump. Two-color, 8-page data sheet 67A describes 6 in. stroke direct flow pump series. Gives full details of design and construction including dimension and sectional drawings, performance data and pump specifications. Lists applications, including chemical handling, descaling systems, hydraulic systems, and oil field service. The Aldrich Pump Co.

255—Sump Pumps. Engineered design and construction features in vertical sump pump line are described in 8-page bulletin 4600A. Cutaways and cross sections show construction details of various units, and diagrams portray typical installations. Selection tables and other data are included. Sizes range from 1 to 10 in. discharge with capacities from 10 to 3000 gpm and heads to 140 ft. The Deming Co.

For more information use one of the handy reply cards between pages 92-93. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you

256—Pumps. Bulletin 7093C, 20 pages, gives complete details on compact motor and pump combination in a variety of sizes and models, ranging from 10 to 1800 gpm with heads to 650 ft. Photos and drawings illustrate design and construction features while performance, dimensions and engineering data are given in tabular form. Typical pump problem is presented and solution given. Ingersoll-Rand Co.

257—Reciprocating Pump. Recently developed 3 in. stroke, direct flow pump is described in 6-page bulletin 64A. Presents features of design, construction, dimension drawings and performance data. Recommended applications include chemical handling, hydraulic systems and oil field service. The Aldrich Pump Co.

258—Packings & Gaskets. The 95 most popular packings and gaskets in the R/M line are illustrated and described in 32-page bulletin P100C. Furnishes complete description of construction, service recommendations and size information on each item. Features charts showing specific recommendations for the wide variety of applications. Raybestos-Manhattan, Inc., Packing Div.

259—Boiler Feed Pumps. Bulletin 1525 contains complete description and cross section drawing of high pressure barrel-type boiler feed pump. Features listed include: Available for pressures to 3000 psi; ability to be thrown on the line quickly; automatic balance; double volutes; individually bolted diaphragms; and, pressure lubricated axially split radial bearings. De Laval Steam Turbine Co.

TOOLS AND SPECIALTIES

262—Tube Expander Control. Precision expanding of heat transfer equipment tubes is covered in 18-page bulletin C350 on electronic tube expander control. Describes and illustrates various units of the control and its correct application. Gives information on op-

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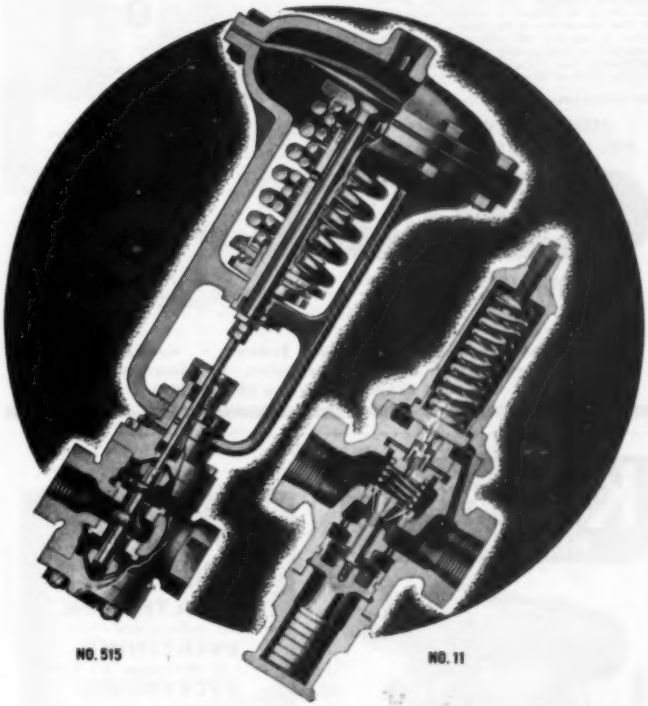

You can depend on Masoneilan performance-proved reducing valves and pump pressure regulators to provide accurate control of steam pressures. Constructed of quality materials throughout, these regulators incorporate many cost-cutting features that assure long operating life with little if any maintenance.

No. 11—Initial pressures up to 250 lbs. reduced to any desired pressure between 5 and 75 lbs. or 75 and 225 lbs. Sizes ½″ to 2″ — bronze; 2½″ to 4″ — iron.

500 Series — Maximum working pressures from 125 lbs. at 350°F, to 250 lbs. at 450°F; pressure ranges ¾-3; 2-8; 6-25; 20-75; 60-160 lbs. Sizes ½″ to 6″.

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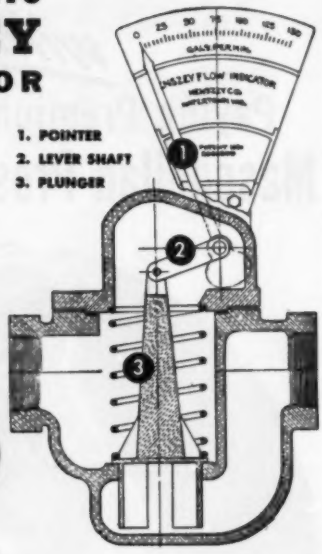
There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the lift of the plunger is in direct proportion to the rate of flow of the liquid. The gradations on the dial are uniformly spaced from one end to another and read direct—without constants. The entire instrument can be installed right in the pipe line.



For details consult Sweet's Catalog or write:

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HENSZEY FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
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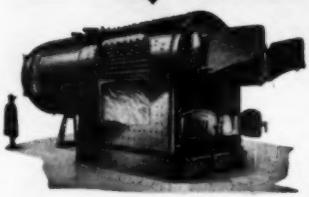

10 to 304 hp
100, 125 and 150 lbs wp

Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

WRITE Department 76-DB for 6" scale with pipe diameter markings

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eration together with maintenance and service hints. Franklin Mfg. Co.

263—Hydraulic Puller. Bulletin 97A, 8 pages, on hydraulic puller (capacity 17½ tons—weight 10 lb) completely describes how the tool with its "Center Hole" feature adapts itself to all OTC pulling systems now in use. Illustrates methods for installing and removing cylinder sleeves, shafts, gears, wheels and other usages. Owatonna Tool Co.

VALVES, PIPING AND FITTINGS

266—Steam Traps. Bulletin T1740 gives 24 pages of information on steam traps. Includes chapters on why use a steam trap, advantages, how to figure sizes, installation and operating suggestions, and how to size condensate return lines. Booklet should be of help to all concerned with steam equipment. Charts and tables include capacities, pipe dimensions, thermo-dynamic properties of saturated steam, along with prices, weights and dimensions. Diagrams show applications, installations, and how the trap works. Yarnall-Waring Co.

267—Swivel Joints. Ball-bearing swivel joints and fabricated products for industrial applications are shown and described in 18-page catalog 50D. Includes thorough discussion of turning principle as well as description of packing units. Sizes, working pressures and temperatures, end connections, and lubricating data are given. Chiksan Co.

268—Steam Traps. "How Increasing Your Steam Costs Can Save Money" offers helpful information regarding the efficient use of steam. Written in easy-to-read style, the 8-page booklet consists of 16 questions and answers that should benefit those concerned in making or using steam. Sarco Co., Inc.

269—Non-Return Valves. Cushioned triple acting non-return valves for steam control in case of damaged boilers or headers are described in 8-page bulletin S1. Said to automatically perform the following functions: cut in boiler when boiler pressure equals header pressure; close to isolate boiler when boiler pressure decreases below header pressure; and close to isolate boiler when header pressure decreases to approximately 8 lbs below boiler pressure. Included are complete technical description, engineering diagrams of three different body and yoke patterns, parts list, and operation and installation instructions. Golden-Anderson Valve Specialty Co.

270—Hose Fittings. Two bulletins are available on hose fittings and line oilers. Bulletin H1200-B44 on hose fittings includes sizes, parts numbers and applications. Fittings include hose nipple, union nut, hose clamp, coupling spud, reducing coupling spud, spud, reducing spud, threaded pipe nipple, hose valve and splicing nipple. Specification sheet H1200-B45 pictures and describes 2 qt line oiler, giving detailed specifications. These bulletins are the first in series superseding the Blue Brute Accessories Catalog. Worthington Pump & Machinery Corp.

271—Alloy Steel Tubing. Assistance in

solving problems involving the use of alternate grades of low carbon, or carburizing grades of tubing steels, is offered in 4-page bulletin TDC149. Presents condensed data on microstructure, critical points, effect of alloy elements, forging, machining, welding and thermal treatment for 14 well-known alloy steels. The Babcock & Wilcox Tube Co.

272—Heavy-Duty Couplings. Heavy-duty Wedge-Lock coupling for use on temporary or permanent pipe lines is illustrated and described in 4-page bulletin 513. Speed and simplicity of connection are features, according to the description. Complete specifications are included in range of light-weight pipe sizes from 8 to 30 in. diameter. Naylor Pipe Co.

274—Condenser Tube Manual. Compact 120-page ready reference manual tells the whole story of tubes used for condensers, heat exchangers, evaporators and general piping. Deals with corrosion-resistant alloys and gives the results of research and study of corrosion. Contains a wealth of information and suggestions on application, installation and maintenance of condenser tubes. Bridgeport Brass Co.

275—Relief Valves. Protect equipment against dangerous pressure increases. Bulletin 711 gives full information on line of forged steel relief valves of seat and ball disk type. Edward Valves, Inc.

276—Stainless Steel Valves. Full line of stainless steel valves, fittings and accessories are covered in 48-page catalog. Gate, globe, angle, needle, Y, and check valves are some of the units illustrated and described. Diagrams and tables show design features, sizes and specifications. Table on corrosion resistance of stainless alloys is included as is materials reference chart which gives suggested applications. The Cooper Alloy Foundry Co.

HEATING, VENTILATING AND AIR CONDITIONING

281—Dehumidifiers. "A Few Facts About Dehumidification For Industry" contains 4 pages of valuable information on dehumidification. Some subjects covered are: what is meant by relative humidity and how it is computed; what are signs and results of too much humidity; methods of removing moisture from the air; and tables of recommended humidities in various industries. Abbeon Supply Co.

282—Air Cleaner. Precipitron electronic air cleaner is presented in 8-page bulletin SA6691. Describes the Precipitron and explains how it operates; why it cleans air efficiently; where it can be used; how it is constructed; and, how to select unit for a given application. Westinghouse Electric Corp., Sturtevant Div.

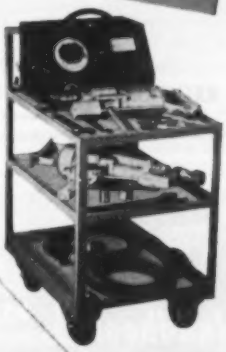
MISCELLANEOUS

283—Alloy Metal Products. Bulletin 303, 8 pages, lists facilities for producing all types of processing equipment, including steam heated units, to your specifications. Pictures and discusses some of the units fabricated and mentions facts about the organization. Photos show equipment and machines available for the job. Martin-Quaid Co.

keeping jobs AHEAD OF SCHEDULE is easy with AIRETOOL

Even your least experienced operator can finish rolling a tough tube bundle way ahead of schedule. Industrial plants now using this new AIRETOOL tube rolling control save valuable hours every time it is put in service.

It's simple to operate. Just insert the ball bearing type expander in the tube to be rolled and when it is perfectly expanded the control automatically shuts off the motor. Expansion guesswork has been eliminated.



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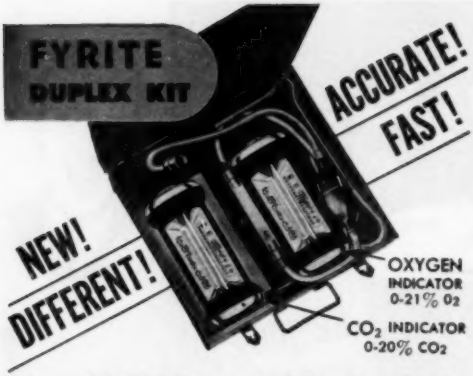

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This newly-developed FYRITE Test Set comprises two separate indicators—one for direct CO_2 analysis, the other for direct Oxygen analysis. Both instruments employ the fundamental principle of chemical absorption. The absorbing fluid used in each instrument is selective in its affinity for CO_2 or Oxygen, respectively, and is not affected by the presence of other gases. The instruments are portable; require no setting-up, have no valves or leveling bottle to manipulate. They are packed in a compact carrying case together with a complete rubber aspirating assembly for connecting either instrument to the desired sampling point.

For complete particulars write for Leaflet 700-342

BACHARACH Industrial Instrument Company
7000 Bennett Street • Pittsburgh 8, Pa.

"SPOT" NEWS OF INDUSTRY

(Continued from page 91)

Sun Oil's Marcus Hook refinery in response to an urgent government appeal for industry action to relieve critical shortages of benzene, toluene xylenes.

The Sun plant will produce 13 million gal per year of benzene, 30 million gal of toluene, and 15 million gal of xylenes. The benzene production alone will provide almost one-eighth of the government's announced requirements of over 100 million gal per year.

The new plant will couple an "Arosorber" with a 10,000 barrel per day catalytic reformer which produces benzene and other aromatic hydrocarbons in an impure state. Then the "Arosorber" concentrates and purifies the aromatics.

Research teams of Sun Oil Co. chemists and engineers spent over eight years in developing a "laboratory curiosity" into the new commercial process now added to the petroleum refiner's kit of tools. They coined the name "Arosorb"—a contraction of aromatic adsorption—to describe the process' use in extracting various types of aromatics from petroleum.

The Davison Chemical Corp. cooperated with Sun's engineers by developing the special silica gel used in the process. The highly porous structure of silica gel gives the ability to separate large quantities of aromatics. The new process has flexibility of operation allowing adaption to recovery of other petroleum products and separaton of many chemicals otherwise difficult to purify.

Here are a few of the many Smooth-On repairs for plant, shop, and home found in this pocket-sized handbook:

- Sealing cracks and leaks in pumps, heaters, apparatus, piping.
- Tightening loose parts of apparatus, fixtures, tools.
- Stopping leaks in basement walls.
- Repairing cracked concrete floors.

Write for your free copy of the Smooth-On repair handbook today. The simple directions and clear pictures will help you to make hundreds of time-saving, money-saving repairs.

ONE OF THE TEN SMOOTH-ON REPAIR CEMENTS

Smooth-On No. 1, used on iron, steel, brass and other metals, is a quick hardening repair cement that comes in 7 oz. 1 lb, 5 lb, 20 lb and 100 lb sizes. If your supply house hasn't it, write us.

SMOOTH-ON SO.309

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Address.....
City.....*State*.....

MERCOID

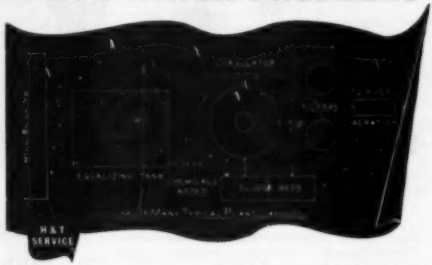
FOR INDUSTRIAL APPLICATIONS REQUIRING POSITIVE CONTROL OF PRESSURE, TEMPERATURE, LIQUID LEVEL ETC.

CONTROLS PERFORM IMPORTANT RESPONSIBILITIES, AND SHOULD BE SELECTED WITH DISCRIMINATION

WRITE FOR CATALOG 700 -- PLEASE MENTION THIS PUBLICATION

THE MERCOID CORPORATION
4201 BELMONT AVE. CHICAGO 41, ILL.

HOW HUNGERFORD & TERRY TREATS INDUSTRIAL WASTE WATER PROBLEMS



1. Survey of flow rates, quantity of water, available equipment, space, pipe sizes, and other information.
2. Analysis of representative waste water samples, to determine the most efficient and economical treatment. A complete report on treatment and treatment cost is submitted.
3. Build model waste water treating unit from our laboratory findings. A quantity of waste water is passed through the model in the presence of plant representatives. Samples are analyzed to show treatment process.
4. A formal proposal is prepared and submitted with a schematic drawing to show operating arrangement and complete guarantees of EFFLUENT capacity and quality.
5. Work in close co-operation with all national, state and local government authorities.

Write For More Information

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Clayton 1, New Jersey

AIR FORCE routs the enemy!

Don't let Dirt, Dust, and Grit shorten the life of your machinery and equipment. Blast the destroyers out of every crack and crevice with a CLEMENTS-CADILLAC blower-suction cleaning tool. Good maintenance pays!

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ASK YOUR MILL SUPPLY DEALER OR WRITE US FOR DATA

air is expensive

IN THE WRONG PLACE

Air mixed with the steam in your heaters or coils is expensive because it retards heat transfer and lowers steam temperature. Remove air from steam heated machines with *Sarco thermostatic air vents.* Write for Bulletin 276 and the name of the Sarco man nearest you. He can help you select the best vent for your purpose and the right place to install it.

Represented in Principal Cities 502

sarco

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Sarco Canada, Ltd., Toronto 5, Ontario

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Seal Pipe Joints and Gaskets with Leakproof KEY Graphite Paste

Key Graphite Paste will hold a pipe joint leakproof against all petroleum based liquids. Key lubricates as it seals and positively will not freeze the joint.

Key Paste is listed by the Underwriters' Laboratories.

Your jobber will supply you or send for liberal sample and try Key at our expense.

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FREE SAMPLE

KEY COMPANY, 321 South 27th Street, East St. Louis, Ill.

Gentlemen: Please forward free sample of Key Graphite Paste.

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WATER JACKETED APCO PUMP

Developed especially for the efficient handling of high temperature and highly volatile liquids. Delivers outstanding performance. Unbeatable on high head, small capacity duties.

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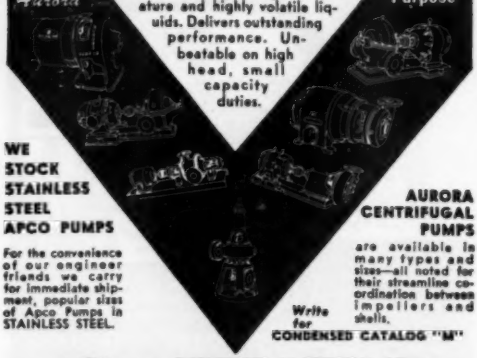

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AURORA CENTRIFUGAL PUMPS are available in many types and sizes—all noted for their streamline coordination between impellers and shells.

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ILLINOIS

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Equip your radiators with smooth-acting Illinois Supply Valves and sensitive, steam tight Illinois Thermo Traps.

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Illinois Float and Thermostatic Traps are made in three Series to meet a wide variety of applications and for operating ranges from 50 pounds pressure to 25 inches vacuum.

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ILLINOIS ENGINEERING COMPANY

INCORPORATED 1900

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LUBRICATION ECONOMY

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This remarkable saving was reported to us by the Wolverine Shoe & Tanning Corporation of Rockford Michigan. Their unsolicited letter stated—"*For every dollar we pay for LUBRIPLATE Lubricant No. 100 we save $7.00 in chain replacements*". You, too, can enjoy the savings made possible with LUBRIPLATE Lubricants.

1. LUBRIPLATE reduces friction and wear
2. LUBRIPLATE prevents rust and corrosion
3. LUBRIPLATE is economical to use

Write today for case histories of savings made through the use of LUBRIPLATE in your industry.

LUBRIPLATE DIVISION
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The Different LUBRICANT!

DEALERS EVERYWHERE, consult your Classified Telephone Book

no coddling pul-leeze

STACON TEMPERATURE REGULATOR*

*Patented

You can install a Farris Stacon Temperature Regulator and forget all about it. You *know* it will operate positively and accurately under *all* conditions and at *all* times.

The Farris Stacon Temperature Regulator is dirt-proof, trouble-free. It operates with unheard of accuracy—to within plus or minus 1 deg. And that's not just under ideal circumstances. It functions with identical accuracy in the worst possible surroundings—provides air-operated sensitivity at self-operated cost.

Here's why: In patented Stacon Regulators, there are no packing glands to leak or bind. The liquid in the bulb flashes to vapor in the power bellows, providing hair-trigger response to move the valve disc.

You'll want complete details on this accurate and economical temperature regulator. Write for Stacon Bulletin 50-10C.

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FOR SALE or TRADE
CIRCLE SHEAR

1—Kling circle shear and flanger. ¼" capacity, 36" throat; 3 h.p. motor complete with overload and controls, 1 set shearing dies, 1 set flanging dies. New April 1949. Used less than 50 hours.
Will sell or trade toward ¼" x 10' or larger mild steel press brake.

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St. Joseph, Michigan

For Sale: 4 used Westinghouse Regulating Street Lighting transformers, Primary voltage 2200 (with taps), 68 KW, 60 cycle, 2 circuit, style #326332A, Price $350.00 each or 4 for $1200.00. For particulars write James B. Lewis, Supt. Municipal Electric Dept., City of Watertown, N. Y.

PREFABRICATED STEEL BUILDING

40' wide x 258' long x 20' clear span. Repainted, in excellent condition. Dismantled. Suitable as is for dry storage only; can be made suitable for production as interior is available Stran-Steel. Price $8000 f.o.b. Chicago area, or will sell any smaller length of building in multiple of 10'.

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INDUCED DRAFT FAN—68700 CFM American Blower Corp. — Driven by Worthington Turbine with gear.

FORCED DRAFT FAN—39000 CFM Green Fuel Economizer — Terry Turbine.

Both used less than 9 months.

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EXCELLENT POWER UNITS

2—125 KVA Westinghouse AC generators, 440 volts, 227 RPM. Powered by 2 Bruce Mac Beth gas/gasoline engines.

1—150-HP, 225 RPM, Synchronous motor.

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More than 70 Peacock Designed Plants prove... *"There's No Substitute For Experience"*

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STEAM ENGINEER

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St. Joseph, Mich.

AVAILABLE REPRINTS

SPECIAL REPRINT
of the report on
INDUSTRIAL WASTE TREATMENT

To fill requests we've received for additional copies of the special report on "Industrial Waste Treatment", June 1951 issue, it has been necessary for us to re-order reprinted copies. These copies are still being offered to our readers ***free of charge in quantities of 1 to 5.*** However, it is necessary for us to make a small charge, sufficient only to defray printing costs, for larger quantities. These prices are: 6 to 25 copies—25¢ each; 26 to 50 copies—20¢ each; more than 50 copies—15¢ each. Order the copies you need directly from Reader Service Department, INDUSTRY AND POWER, 420 Main Street, St. Joseph, Michigan.

We also have a few copies of the following article reprints which are available to you free of charge:

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"Correct Plans Consider Future Expansion Too", December, 1950.

"Filters . . . What They Are, How and Why They Are Applied", February, 1951.

"Grievances Can Be Avoided", April, 1950.

"Harbor Plant Pioneers in Pneumatic Build-Up Refractory", December, 1950.

"How to Select the Correct Steam Trap", January, 1950.

"How To Select Corrugated Expansion Joints", June, 1950.

"Know Your Fuses", March, 1951.

"Low Cost Auxiliary Power From Turbine Drives", April, 1950.

"Monsanto Builds Ideal Process Steam Plant at Everett, Mass.", June, 1950.

"Proper Water Tower Means Water Conservation", March and April, 1951.

"Qualifications of an Industrial Supervisor", June, 1949.

"Select Correct Batteries for Starting Diesels", Nov., 1949.

"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.

"Simplify Determinations of Pipeline Pressure Losses", November, 1949.

"Steam, Air, and Power for 3 New Ford Assembly Plants", May, 1949.

"Streamlined Steam Plant Insulation", May, 1951.

"Supervisor's Personal Check-Up Chart", November, 1949.

"Synchronous Motors Do Two Jobs at One Time", February, 1950.

"Television . . . The Eyes of Industrial Control", Dec., 1950.

"Trigonometric Calculations — I and II", April, 1951.

"Water Treatment for Air Conditioning Systems", May, June and July, 1949.

"Willmar, Minn., Increases Capacity of Municipal Power and Heating Plant", April, 1951.

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Restore Broken Floors...F-A-S-T!

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SETS INSTANTLY!

TAMP SMOOTH! TRUCK OVER!

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3605 Filbert St., Philadelphia 4, Pa.

Please send me complete INSTANT-USE information, details of TRIAL ORDER PLAN and HAND BOOK OF BUILDING MAINTENANCE—no obligation. (Clip and attach Coupon to Co. letterhead).

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Company .....
Address .....

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- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

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36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

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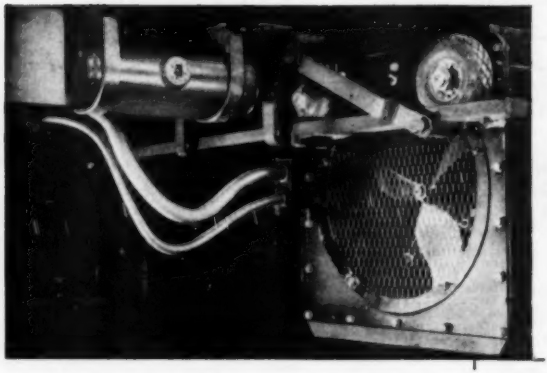

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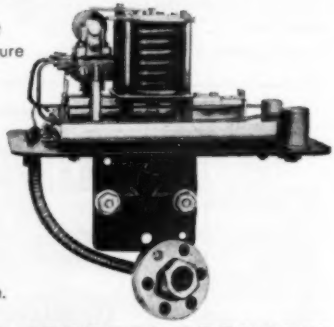

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